AVIATION WEEK

MAR. 15, 1954

THIS ISSUE $1.00

A McGRAW-HILL PUBLICATION

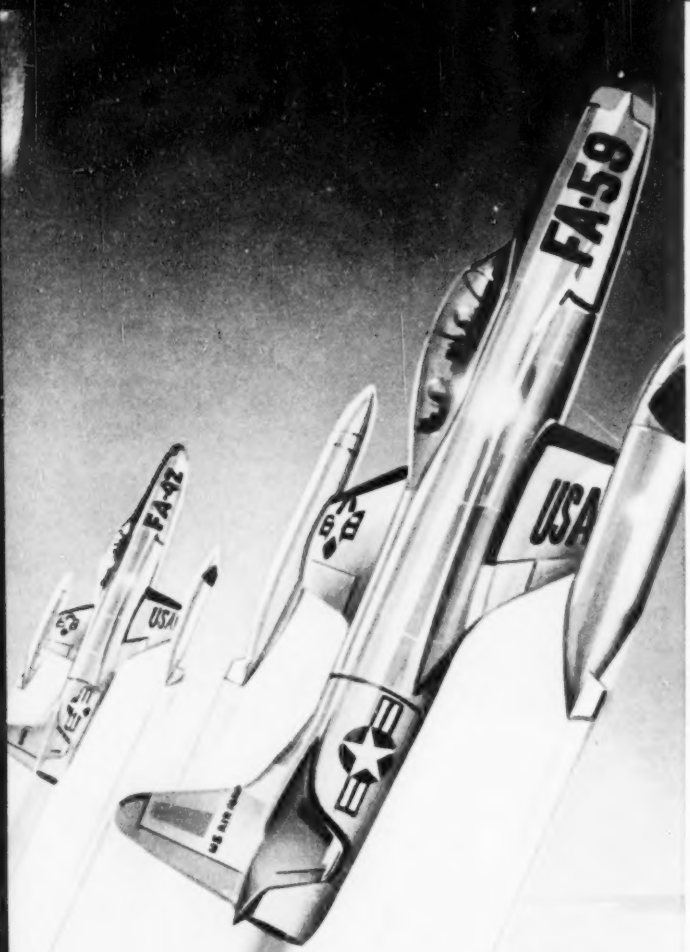
The Twenty-first Annual
INVENTORY OF AIR POWER
New Airpower Doctrine

SPECIAL DELIVERY ... for strategic air power!

Convair's globe-roaming B-36 is also an airport in the sky

Something new has been added to the B-36 bomber, already the most effective and versatile aerial weapon in history. Fighter aircraft such as Republic's sweptwing photo-reconnaissance version of the Thunderstreak, can be launched and retrieved by a B-36 "mother ship" in flight anywhere in the world. No extension of the U.S. Air Force strategic air arm could be more economical or timely. **Engineering to the Nth power**

SAN DIEGO & POMONA, CALIFORNIA
FORT WORTH & DAINGERFIELD, TEXAS
CONVAIR



100 Complicated Math Problems-Per-Minute Are Solved For Him AUTOMATICALLY!

As jet-powered planes streak to new altitudes and speeds, they undergo split-second changes in temperature, pressure and moisture conditions. These changes create a flood of amazingly complex fuel metering problems. Adding to the complication are the pilot's changing demands from his engine.

Solving these fuel metering problems is equivalent to solving one hundred computations every 60 seconds! The Holley Turbine Control was developed to do the job.

Manufacturing the Holley Turbine Control required highly specialized skills, too. Working to extreme tolerances, Holley's manufacturing division has produced precision turbine controls for thousands of the nation's jet engines.

HOLLEY
Carburetor Co.

11931 NINE MILE ROAD
VAN DYKE, MICHIGAN

LEADER IN THE DESIGN, DEVELOPMENT AND MANUFACTURE OF AVIATION FUEL METERING DEVICES

The news about pneumatics is that it is on the way to becoming the *actuating power of the future. Gun chargers, emergency power actuating systems and other utility power applications developed by Kidde have already proved the vast potentialities of pneumatics in the field of aviation.*

Aviation engineers are finding more and more uses for pneumatic power . . . a sign that the all-pneumatics aircraft may be just over the horizon.

Yet, for all the news it's making in aviation, pneumatics certainly isn't new. *More than 250 years ago, Denis Papin compressed air by power from a water wheel. And in 1849, Baron Von Rathen proposed to compress air in stages with a series of intercoolers to get 750 pounds pressure for use in locomotives. Today, a Kidde compressor the size of a table radio will deliver 3000 PSI! Think what this means where weight is a factor...*

Pneumatic systems for aircraft are light, simple and safe. The use of air insures an unlimited supply for the system, and eliminates the fire hazard. Pneumatic systems operate over a wide temperature range with exceptionally high energy delivery . . . can move huge loads quickly and easily.

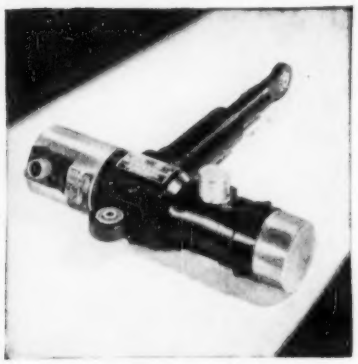
We here at Kidde see a great future for pneumatics in aviation, and have been fortunate in being among the first to explore the applications of this exciting force. Perhaps you, too, are seeking new ways to apply this well-known energy source. If you have a problem in pneumatics, write us.

The words 'Kidde', 'Fyre-Freez' and the Kidde seal are trademarks of Walter Kidde & Company, Inc.

Kidde

Walter Kidde & Company, Inc.
Main St., Belleville 9, N. J.
Walter Kidde & Company of Canada, Ltd., Montreal—Toronto

LINEATOR
is years ahead



Lineator

The Chance-Vought Cutlass was an advanced design in 1947. It is a leader today. The same is true of Airborne's LINEATOR, which was developed for the Cutlass flight control system. Today, seven years later, there is not another "tee" type linear actuator like it.

The same basic model is used in the latest of the Cutlass series, and in the McDonnell Banshee. Modifications of the LINEATOR are specified equipment in the McDonnell Demon; its Air Force companion, F-101; and the Martin P5M patrol bomber.

Conforming to MIL-A-8064 (USAF), the LINEATOR is most adaptable where light weight and short length, for a given stroke, are desirable features. A ball bearing jack screw enables it to handle 1500 lb. maximum operating load in either tension or compression.

Airborne has set the pace in the actuator field with advanced designs like the LINEATOR. As aircraft configurations change and speeds increase, count on Airborne for more of the same. For information on the LINEATOR and other actuators, see our literature in the I.A.S. Catalog.

AIRBORNE
Accessories Corporation
HILLSIDE 5, NEW JERSEY

Aviation Week

March 15, 1954 — Vol. 60, No. 11

Editorial Offices
New York 36—330 W. 42nd St., Phone LOngacre 4-3000 (Night, LO 4-3035)
Washington 4, D. C.—National Press Bldg., Phone NAtional 8-3414
Los Angeles 17—1111 Wilshire Blvd., Phone MAdison 6-4323

Table of Contents on Page 37

51,326 copies of this issue printed

Robert W. Martin, Jr. ..... *Publisher*
Robert H. Wood ..... *Editor*

Robert B. Hotz
Executive Editor

Merlin H. Mickel
Managing Editor

Albert W. Bentz ..... **News Editor**
David A. Anderton ..... **Engineering**
Irving Stone ..... **Technical**
G. L. Christian ..... **Equipment, Maintenance**
Katherine Johnsen ..... **Congress**
Philip Klass ..... **Avionics**
Erwin J. Bulban ..... **Special Assignments**
Richard Balentine ..... **Transport**
Frank Shea, Jr. ..... **Transport**
William J. Coughlin ..... **West Coast**
Bernie Lang ..... **West Coast Assistant**
Henry Lefer ..... **News Desk**
Gordon C. Conley ..... **News Desk**
G. J. McAllister ..... **Washington News Desk**
Lawrence J. Herb ..... **Art Editor**
Victoria Giaculli ..... **Editorial Makeup**
Leo T. Tarpey ..... **Printing & Production**

DOMESTIC NEWS BUREAUS

Atlanta 3 ..... 807 Rhodes-Haverty Bldg.
Chicago 11 ..... 520 No. Michigan Ave.
Cleveland 15 ..... 1510 Hanna Bldg.
Detroit 26 ..... 856 Penobscot Bldg.
Houston 25 ..... 1303 Prudential Bldg.
Los Angeles 17 ..... 1111 Wilshire Blvd.
San Francisco 4 ..... 68 Post St.
Washington 4 ..... 1189 National Press Bldg.

FOREIGN NEWS SERVICE

Editor ..... Joseph K. Van Denburg, Jr.
London ..... Nathaniel McKitterick
Paris ..... Ross Hazeltine
Frankfurt ..... Gerald W. Schroder
Manila ..... Herbert Leopold
Mexico City ..... John Wilhelm
Sao Paulo ..... Lionel J. Holmes
Tokyo ..... Alpheus W. Jessup

Aviation Week is served by PRESS ASSOCIATION, INC., a subsidiary of Associated Press.

Research and Marketing: Catherine Miner, **Director**; Jane Grube, Jane Moffat and Mary Detwiler, **Assistants.**

J. G. Johnson ..... *Business Manager*

Sales Representatives: J. C. Anthony, **New York**; H. P. Johnson, **Cleveland**; D. T. Brennan and J. S. Costello, **Chicago and St. Louis**; E. P. Blanchard, Jr., **Boston**; James Cash, **Dallas**; Robert H. Sidur, **Atlanta**; R. E. Dorland, **San Francisco**; C. F. McReynolds, **Los Angeles**; W. S. Hessey, **Philadelphia**; C. A. Ransdell, **Detroit.** Other sales offices in **Pittsburgh, London.**

AVIATION WEEK • March 15, 1954 • Vol. 60, No. 11
Member APB and ABC

Published weekly by McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. **Publication Office: 99-129 North Broadway, Albany 1, N. Y.**
Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.
Subscriptions: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow 10 days for change of address.
Subscriptions are solicited only from persons having a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.
Single copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par; other Western Hemisphere, $10 a year; $16 for two years; $20 for three years. All other countries $20 a year; $30 for two years; $40 for three years. Entered as second-class matter, July 16, 1947, at the Post Office at Albany, N. Y., under Act of Mar. 3, 1879.

Printed in U. S. A. Copyright 1954 by McGraw-Hill Publishing Co., Inc.—All Rights Reserved.
Cable Address: "McGraw-Hill New York." Publications combined with AVIATION WEEK are AVIATION, AVIATION NEWS, AIR TRANSPORT, AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL.
All rights to these names are reserved by McGraw-Hill Publishing Co.

The Douglas "Cloudster"—1920

—the beginning of the World's Largest Aircraft Plant!

In 1920, a young engineer named Donald Douglas, with a group of aviation trail-blazers, built the "Cloudster" in an old abandoned lumber mill in Los Angeles, California. It was the first airplane to carry successfully the equivalent of its own weight, and it helped put Douglas in competition with the foremost plant builders in this country. Soon after the "Cloudster" was exhibited to the Navy, Douglas won a Navy contract for three torpedo-planes. More soon followed—and the young Douglas Aircraft Company was on its way!

No other industry has contributed more to aviation's progress than the petroleum industry. And Phillips Petroleum Company has been one of the pioneers in developing new fuels to meet aviation's ever-changing demands.

New fuels for the very latest developments in turbo-props and jets are today constantly under development in the Phillips laboratories. And Phillips also has tremendous capacity for producing 115/145 grade aviation gasoline.

For the finest aviation products specify Phillips—one of the nation's largest suppliers of aviation fuels for military as well as commercial use.

AVIATION DIVISION
PHILLIPS PETROLEUM COMPANY
BARTLESVILLE, OKLAHOMA

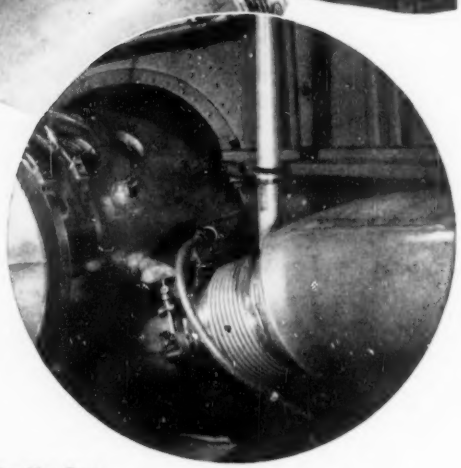
TODAY Douglas is the world's largest aircraft manufacturer! Typical of Douglas' great strides in the designing and manufacturing of planes is the Douglas C-124 Globemaster II, an all-purpose giant transport built for the U. S. Air Force. Its extreme flexibility makes it one of the most versatile cargo and troop carriers in the air today.

Phillips 66

AVIATION PRODUCTS

REX-FLEX flies with the new DC-7

Photos courtesy, Douglas Aircraft Company, Santa Monica, California.



Anti-icing and cabin heater ducting of Douglas' newest transport protected with REX-FLEX connectors.

In the new Douglas DC-7—as in virtually every aircraft built in this country—Flexonics stainless steel assemblies play a part in vibration control. Flexible connectors for the cabin heating and anti-icing system are REX-FLEX corrugated stainless steel assemblies. These units are designed to isolate vibration and noise in rigid ducting and prevent its transfer to the air frame. Like all Flexonics products, these units are scientifically engineered to do their job right . . . proved in the extensive Flexonics labs before going into production . . . carefully fabricated under rigid quality control.

Experience and facilities second to none are your best assurance of getting exactly what you want when you specify Flexonics stainless steel ducting, hose, bellows and flexible connectors. For recommendations, send an outline of your requirements.

Upper circle—Rex-Flex Type RF-40 flexible connector in the anti-icing systems

Lower circle—Rex-Flex Type RF-40 flexible connector in the cabin heating system.

Flexonics *Corporation* **AIRCRAFT DIVISION**
1302 S. THIRD AVENUE • MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Flexon identifies products of Flexonics Corporation that have served industry for over 52 years.

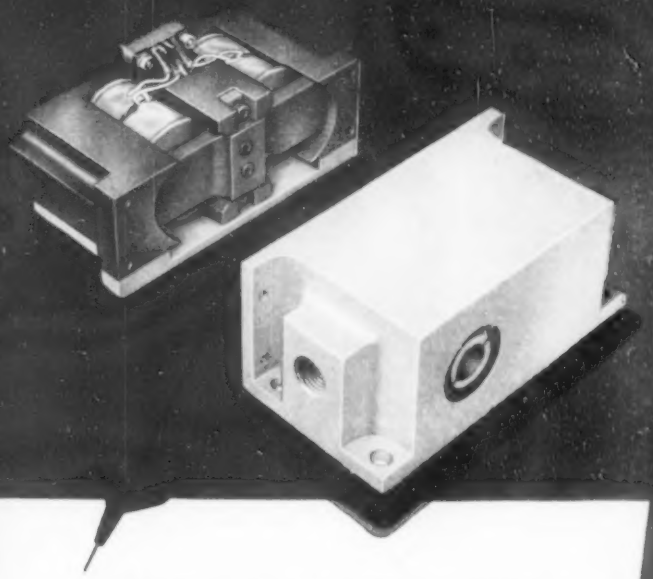
Flexible metal hose

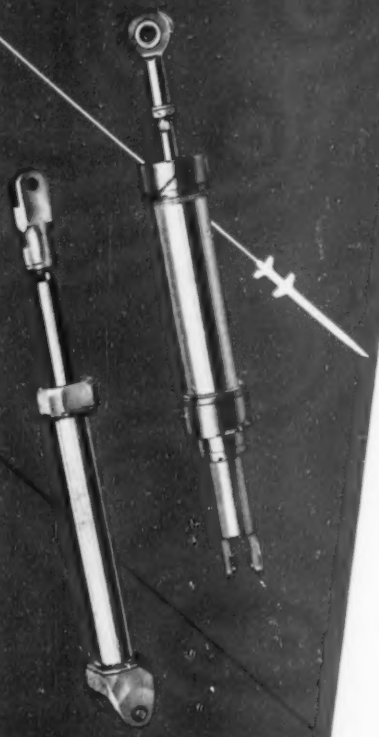
Expansion joints

Aircraft components

Metallic bellows

EXPERIENCE, ABILITY and "KNOW-HOW"





HYDRAULIC SERVOS FOR GUIDANCE SYSTEMS

The analysis of high performance hydraulic servos for guidance systems is very new. We feel, however, that we are "old timers" in supplying the building experience and engineering "know-how".

Years of manufacturing high precision gages and measuring instruments made us a natural choice to complete large quantity manufacture for military and commercial contracts. To date, thousands of component assemblies . . . actuators, proportional transfer valves and torque motors . . . have been built by us to meet both the dimensional and functional needs of our customers.

Our experienced engineers are available to assist you in the development of hydraulic servo systems for every application. And we have the manufacturing, inspection and testing facilities to maintain a high degree of quality and dimensional control in meeting prototype or production schedules.

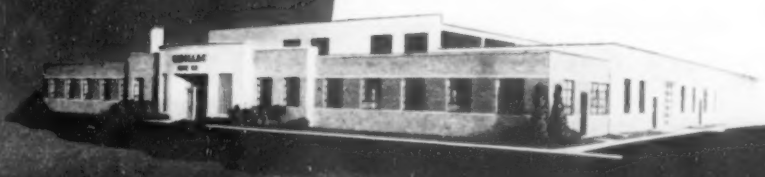
We can help make the dreams of your designers and development engineers come true. Call us next time you have a problem involving servo-mechanisms.

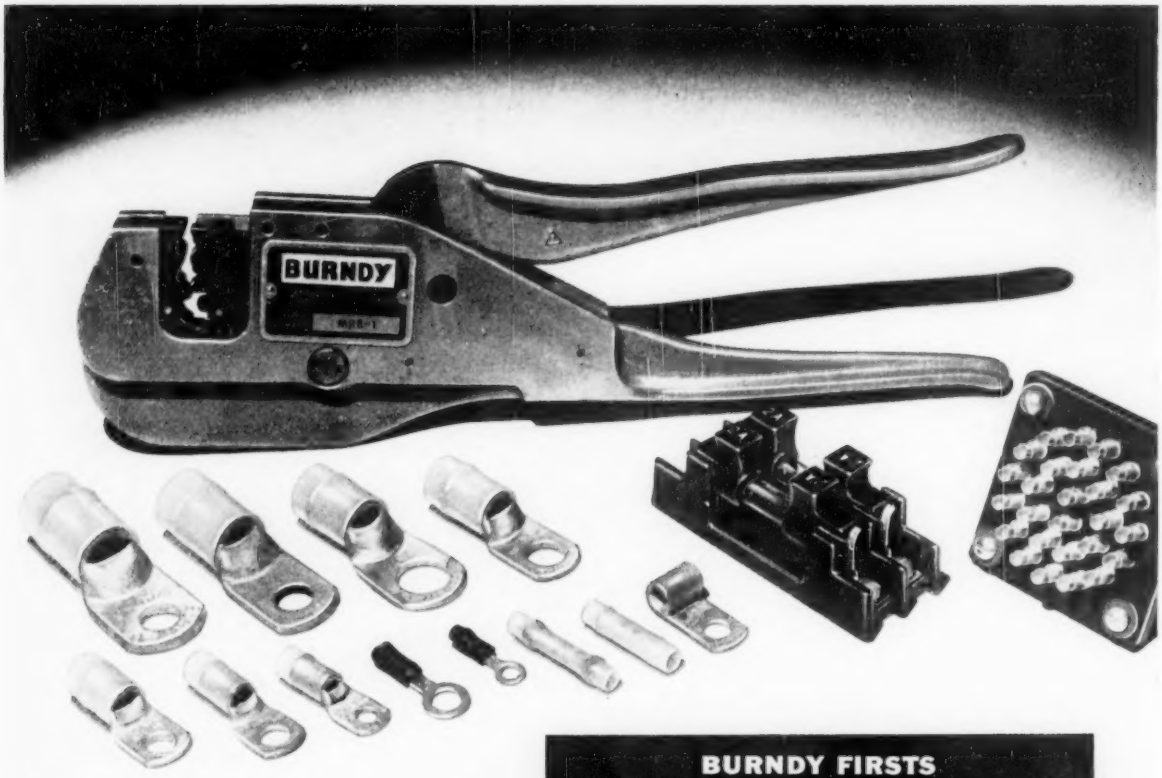
CADILLAC GAGE COMPANY

SPECIAL PRODUCTS DIVISION

P. O. BOX 3806

DETROIT 5, MICH.





FIRST

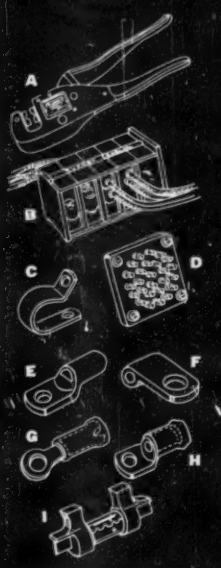
FOR MAXIMUM CIRCUIT SAFETY

YESTERDAY —Many of the most important technical improvements in aircraft electrical harness systems were originated by Burndy engineers working closely with the aircraft industry.

TODAY —Burndy terminals, current limiters and disconnect panels are specified for use in nearly every modern aircraft, military and commercial.

TOMORROW —Products now under development at Burndy will help make future planes still faster, lighter, safer.

BURNDY FIRSTS



A—Manual installation tools for all compression terminals. Bull. 53Y1.

B—Crablok multiple disconnect terminal strip. Bull. CB50.

C—Molded nylon cable hangers. Bull. HP.

D—Pressurized individual disconnect panels. Bull. 53F1.

E—Complete line of compression terminals thru 4/0. Bull. 51Y4.

F—Flag type compression terminals. Bull. 51Y4.

G—Insulated compression terminals thru 2/0. Bull. 59Y4.

H—Insulated aluminum compression terminals thru 1/0 Bull. 53Y4.

I—Limiters for circuit protection Bull. 51F2.

(Write Aircraft Products Division for specific bulletin)

BURNDY

AIRCRAFT PRODUCTS

NORWALK, CONNECT. FACTORIES: New York, California, Toronto **TORONTO, CANADA**
EXPORT: Philips Export Corporation

53-25

For more than thirty years, The Liquidometer Corporation has concentrated almost exclusively on the research, design, manufacture, installation and service of liquid quantity measurement systems.

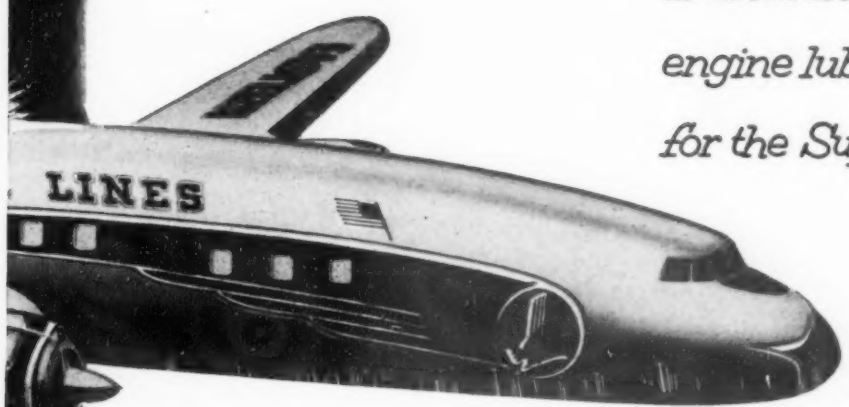
CAPACITOR TYPE FUEL QUANTITY GAGES • LIQUIDENSITOMETERS TO PROVIDE TRUE FUEL WEIGHT INDICATION • FLOAT ACTUATED GAGES MINIATURE COAXIAL CABLE CONNECTORS • POSITION TRANSMITTERS • POSITION INDICATORS • FLOAT SWITCHES • LIQUID LEVEL WARNING SWITCHES • LIQUID LEVEL CONTROLS • CENTER OF GRAVITY CONTROL SYSTEMS AND OTHER INSTRUMENTATION

THE LIQUIDOMETER CORP. LONG ISLAND CITY 1, NEW YORK

a New
FLY - EASTERN A.

Eastern adds Constellation to the Skies !

. . . Once again Sinclair is chosen for dependable engine lubrication...this time, for the Super-C.



The newest member of Eastern's Great Silver Fleet has taken to the skies. The latest in Constellations, Eastern Air Lines' SUPER-C is designed to give Eastern passengers faster service with the same dependability proven over *billions* of passenger miles.

As with every airline, Eastern stresses reliable performance – brought about by dependable products. Proof of the aviation industry's confidence in Sinclair may be found in the fact that *45% of the aircraft oils used by major scheduled airlines in the U. S. is supplied by Sinclair.* Why not place *your* confidence in Sinclair Aircraft Oil?

SINCLAIR AIRCRAFT OILS

SINCLAIR REFINING COMPANY, AVIATION SALES, 600 FIFTH AVENUE, NEW YORK 20, N. Y.

SUMMERS

PAR

POSITION AND RATE GYRO

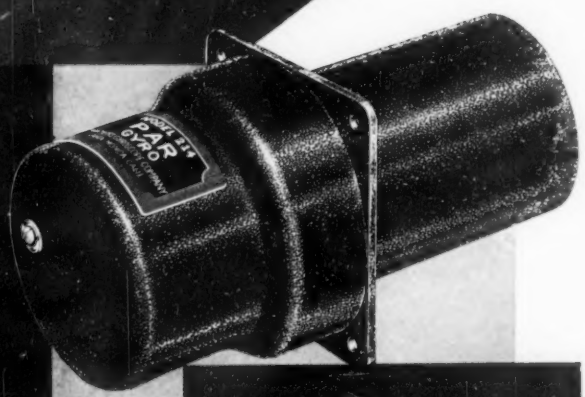
EXCELS AND OBSOLETES

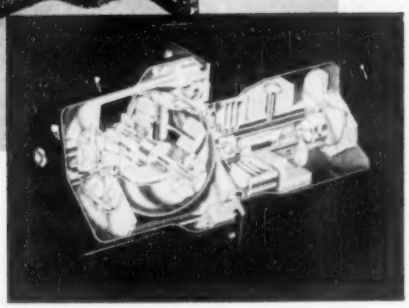
AN ENTIRE SERIES OF

GUIDANCE ELEMENTS

Summers new PAR Gyro ends guidance headaches. Complicated automatic pilots are no longer necessary. Heretofore, position and rate signals were obtained by a position gyro and a separate rate unit, respectively, then algebraically added by a third unit. Summers integrating PAR Gyro provides position plus rate on a single pickoff. Possessing but one degree of freedom it avoids the complexity and limitations of multi-gimbal gyros. Unlimited maneuvering may be called for by applying an appropriate command voltage directly to the Summers single-gimbal PAR Gyro. Drift rates are in the order of 0.1 degree per minute.

Both weight and cost of the PAR Gyro are about one-fourth of the weight and cost of the apparatus it obsoletes.





Write for details on the PAR Gyro, or for information on Summers' facilities for developing and producing components and systems.

SUMMERS

GYROSCOPE

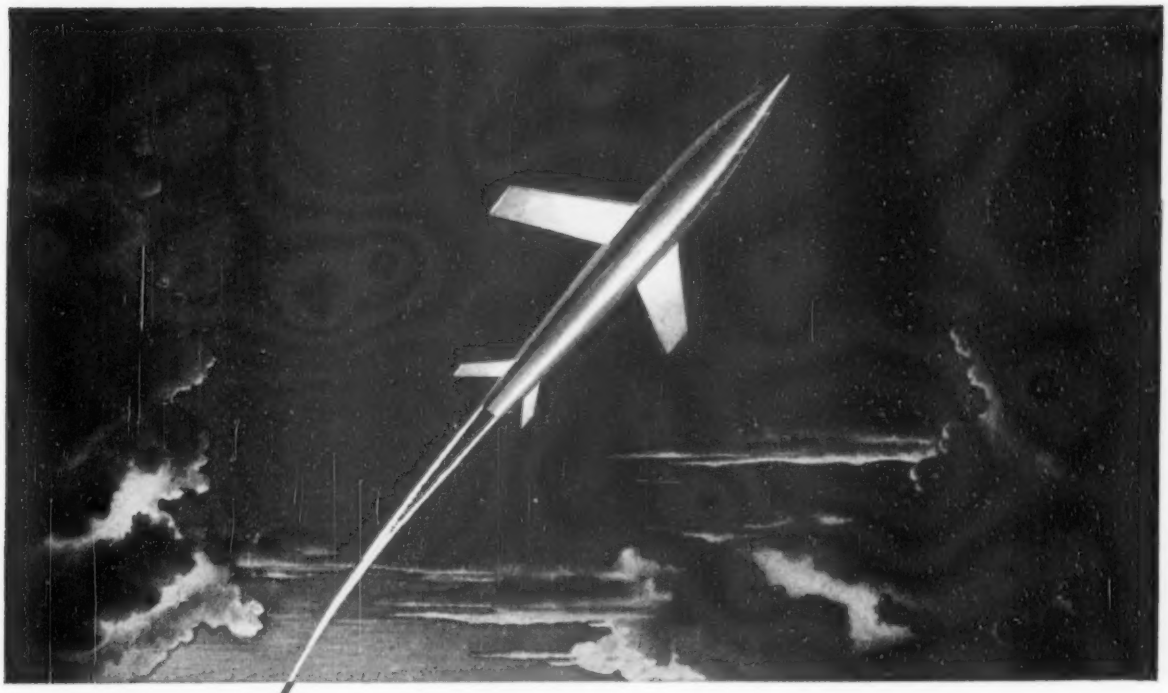
COMPANY

2328 BROADWAY • SANTA MONICA, CALIFORNIA

REPRESENTATIVES:

H. A. Webb, 34 Mann Street, Fairborn, Ohio
W. A. Laukaitis, Suite 724, Cafritz Building, 1625 Eye Street N.W., Washington, D.C.
George E. Harris & Co., Inc., 1734 No. Hillside, Wichita, Kansas

SUMMERS DESIGNS AND PRODUCES ALL WEATHER AUTOPILOTS • RATE GYROS • FREE GYROS • VERTICAL GYROS • TORQUE-TYPE ACTUATORS • POSITIONING-TYPE ACTUATORS • GYRO SERVO ACTUATORS • INTEGRATING MOTORS • ALTITUDE CONTROLS • MAGNETIC AMPLIFIERS • FLIGHT TEST TABLES • INVERTERS • PENDULUM POTENTIOMETERS • RATE INTEGRATING DETECTORS • FREQUENCY DOUBLERS • MAGNETIC FRICTION CLUTCHES • CONTROL AMPLIFIERS • CONTROL SYSTEM TEST EQUIPMENT • SPECIAL CONTROL SYSTEM COMPONENTS • COMPLETE CONTROL SYSTEMS • RADIO RECEIVERS • RADIO TRANSMITTERS • FLIGHT COMPUTERS • CONTROL SYSTEM ANALYSIS SERVICE • ANALOG SIMULATION AND SERVICE • SUMMERS DESIGNS, DEVELOPS AND PRODUCES INSTRUMENTS IN ANY QUANTITY



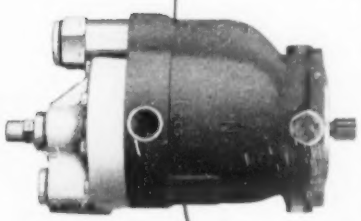
OUTWARD BOUND · · · Controlled All the Way by—

STRATOPOWER
HYDRAULIC PUMPS

To the layman, the pinpointing of a destination for a guided missile is still pure magic. But to the engineer, the control and guidance of rockets and guided missiles in flight simply means another application for STRATOPOWER quality and advanced design.

The unerring performance of STRATOPOWER Pumps has been demonstrated times without number down through the years. At sea level and at heights still to be achieved these perfect examples of precision engineering provide the fluid power that positively answers the question of weight vs. horsepower as well as the equally important requirement of long-lived dependability.

In the designing of any high pressure hydraulic circuit there are definite advantages in STRATOPOWER Pumps. Whether yours is a problem for constant or variable delivery, high or low temperature operation, capacities from .25 to 30 gpm, STRATOPOWER will provide the pump to 3000 psi that will resolve that problem NOW!



The 66W Series of STRATOPOWER Hydraulic Pumps embrace a range of models from 2 to 10 gpm at 1500 rpm with continuous pressures to 3000 psi. Designed for maximum continuous speed of 3750 rpm . . . intermittent speeds to 4500 rpm.

Write ***Get the full story on STRATOPOWER constant and variable delivery Pumps for your hydraulic circuits.***

WATERTOWN DIVISION
THE NEW YORK AIR BRAKE COMPANY
STARBUCK AVENUE • WATERTOWN • N. Y.

WATERTOWN DIVISION
THE NEW YORK AIR BRAKE COMPANY
720 Starbuck Avenue • Watertown, N. Y.

Kindly send me information on STRATOPOWER Hydraulic Pumps

☐ Constant delivery ☐ Variable delivery

Name_____

Company_____

Address_____

City_____ Zone____ State_____

These Controls Guarantee in Fastener Quality and

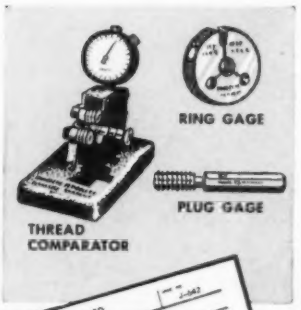
DOI 74-1, [illegible]

RAW MATERIAL CONTROL

The quality of raw material is guaranteed by rigorous chemical, physical and mechanical tests coupled with mill analysis, heat number and purchase order identification. The raw material is then kept in a separate area.

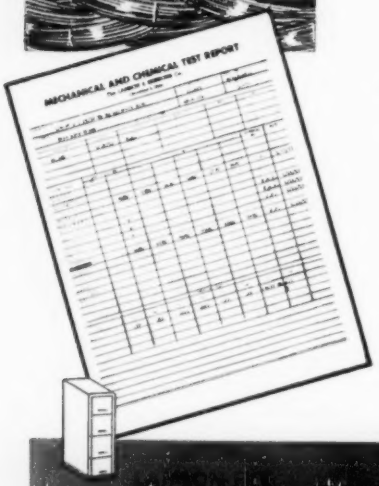
GAGE CONTROL

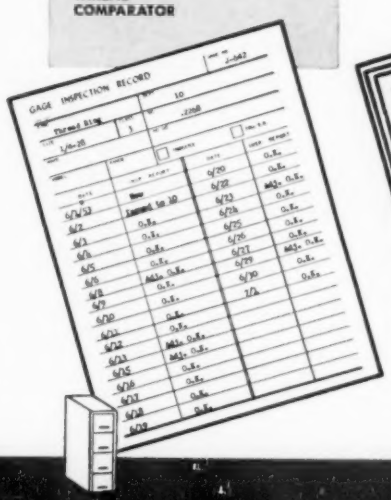
Systematic gage control by periodic checks with gage masters guarantees quality throughout every phase of production and sampling.

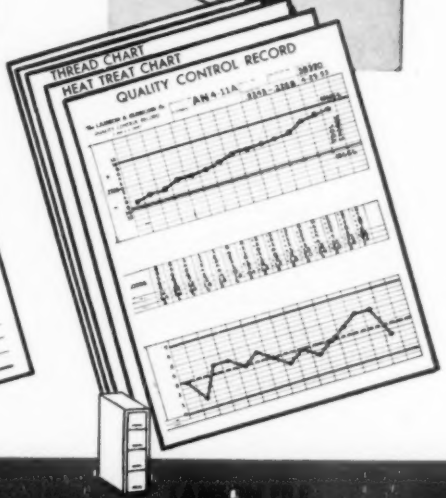


PROCESS CONTROL

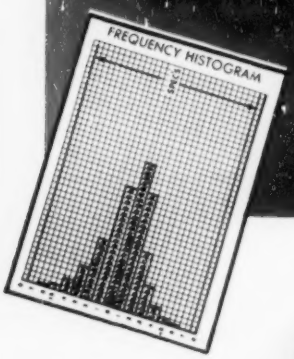
In process, quality is checked by Shewhart Control Charts of ($\bar{X}$, R, p, c, I, etc.) These charts guarantee the control of quality and products "in tolerance".







LAMSON FILE — LAMSON FILE — LAMSON FILE

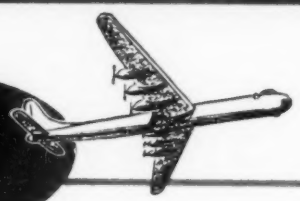


This reservoir of information is invaluable for statistical analyses and management reports.

Studies of these records determine process averages, machine capacities, quality trends, tool and die life,

Order From Your

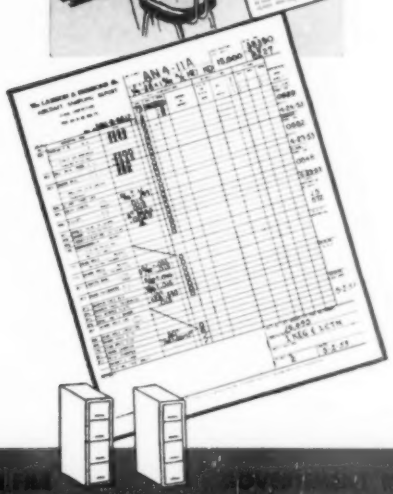
Lamson & Sessions



the Best Value

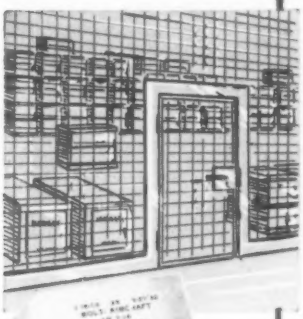
FINAL INSPECTION CONTROL

The quality of finished product is guaranteed by Lamson to specified AQL's (Acceptable Quality Levels) through MIL-STD-105A sampling plans. Source inspection is conducted by a Government resident inspector.

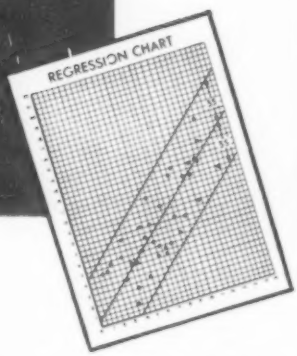


BONDED STOCK CONTROL

The finished aircraft fasteners are stored in a Government approved Bonded Area, assuring you of quality controlled fasteners. Each shipment is identified as "Bonded Stock".



heat treat analyses. Special statistical techniques are: Correlation, Analysis of Variance and Significance Tests.



Authorized Lamson Distributor

LAMSON AIRCRAFT FASTENERS

BOLTS

Aircraft, AN3 to AN20
Clevis, AN21 to AN36
Aircraft, Drilled Head, AN73 to AN81, AN73A to AN81A
Aircraft, Close Tolerance, AN173 to AN186
Hex Head, AN101001 to AN101900
Hex Head, Drilled Shank, AN101901 to AN102800
Drilled Hex Head, AN102801 to AN103700
Drilled Hex Head, 6 Holes, AN103701 to AN104600

NUTS

Castellated, Airframe AN310
Plain, Airframe, AN315
Check, AN316
Plain Hex (Fine Thd.), 325
Castle (S. A. E.), 330
Plain Hex (Coarse Thread), AN335
Light Hexagon (Coarse Thread—Fine Thread), AN340—AN345
Engine—Slotted, AN355
Plain Engine, AN360

PINS

Cotter, AN380
Cotter (Corrosion Resisting Steel), AN381
Flat Head, AN392 to AN406

SCREWS—Slotted

Fillister Head (Coarse Thread—Fine Thread), AN500—AN501
Fillister Head (Drilled Head) (Coarse Thd.—Fine Thd.), AN500A—AN501A
Drilled Filister Head Machine (Fine Thd.—Coarse Thd.). AN502—AN503
Machine, Round Head (Coarse Thread—Fine Thread), AN515—AN520
Washer Head, AN525
Machine, Truss Head, AN526
Sheet Metal Round Head, AN530

SCREWS—Phillips Recessed

Machine, Flat Head, 82° (Coarse Thd.—Fine Thd.), AN505—AN510
Machine, Round Head (Coarse Thd.—Fine Thd.), AN515—AN520
Machine, Truss Head, AN526
Machine, Flat Head, 100°, AN507
100° Flat Head (Structural), AN509
Brazier Head, NAS220 to NAS224
Sheet Metal Round Head, AN530
Sheet Metal Flat Head, AN531
100° Flat Head, Alloy Steel, CT205 to CT208

Screw Machine Products
Special Purpose Fasteners

The LAMSON & SESSIONS Co.

General Offices: 1971 West 85th Street • Cleveland 2, Ohio

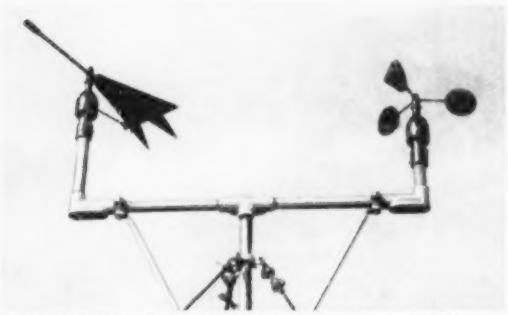
Plants at Cleveland and Kent, Ohio • Chicago • Birmingham

FLY SAFELY

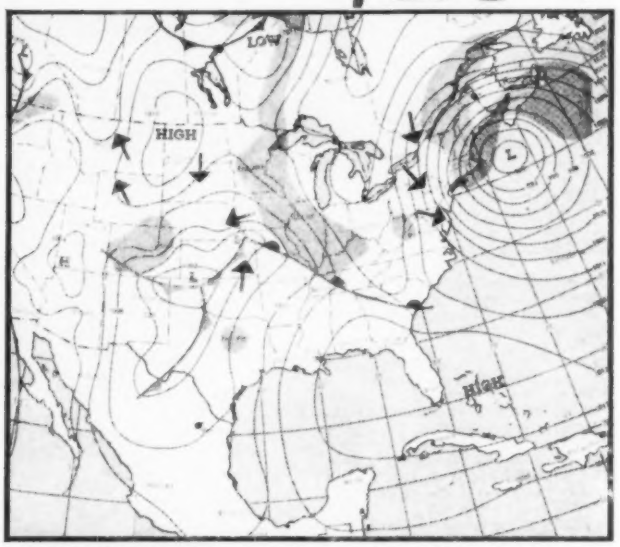
[These weather items prepared in consultation with the United States Weather Bureau]

ALLOW EXTRA MARGIN of air speed when landing in the vicinity of thunderstorms because of sudden wind shifts and gusts. Rapid shifts often accompany the cold downdrafts just ahead of the storm.

WINDS ALOFT usually differ greatly from surface winds. Check the U. S. Weather Bureau's Winds Aloft Analyses, issued 4 times daily and distributed on aviation teletypewriter circuits.



REMEMBER—Airport Towers report landing wind direction in degrees magnetic, like runways. On weather reports, however, wind direction is always with reference to true north. Over 20° difference in some parts of U. S.



AS SHOWN ON MAP, winds blow nearly parallel to isobars—the closer the isobars, the stronger the winds. When facing the wind, high pressure lies to left and low pressure to right. (Northern Hemisphere)

FAST-SHIFTING winds call for quick engine response at a moment's notice. That's why wise pilots protect power and performance with the very best fuels and lubricants—Mobilgas Aircraft and Mobiloil Aero.

These famous Flying Red Horse products meet aviation's toughest tests...exceed rigid Army and Navy specifications ...have the approval of every major aircraft builder.

Fly safely! Fly with the Flying Red Horse!

TWO PHOTOS LEFT, MAP ABOVE COURTESY U. S. WEATHER BUREAU

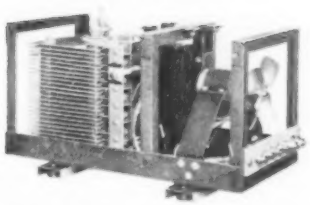
Mobiloil AERO

Mobilgas AIRCRAFT

Best Pair to Get You There

SOCONY-VACUUM OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

Federal supplies the 50-Amp. Transformer-Rectifier unit used in the Stratofortress... "America's new double-edged weapon"



FTR 3146-BS AIRBORNE POWER SUPPLY

● **AC Input:** 195-210 volts; 380-420 cycles; 3 phase. ● **DC Output:** 50 amps.; 24-31 volts; resistive-inductive load. ● **Ripple:** 5% maximum ● **Weight:** 19 pounds ● **Dimensions:** 15 1/8" long; 9" wide; 8 1/4" high.

Over 300,000 pounds of precision production... 185 feet from wing tip to wing tip... drawing its unique speed and ceiling from eight powerful jet engines! That's the Boeing B-52... built to serve as a deterrent against aggression... as a weapon of offense, if needed by our strategic air arm!

In the "tradition of rugged dependability" established by Boeing's famous Flying Fortresses and Superforts, Boeing has selected Federal's 3146-BS Airborne Power Supply to provide the B-52 with a DC output of 50 amperes, 28 volts.

Federal's 3146-BS is only one of a complete line of rugged, compact and efficient airborne and ground power supplies developed to meet aviation's growing trend from *generated* DC to 400-cycle AC... to furnish *dependable* DC power where required. Federal equipments are designed without expendable parts that require frequent replacement. And all are powered by Federal Selenium Rectifiers... *first* in the field... outstanding for long service life and trouble-free performance!

Whatever your DC requirements, write to Dept. E-5110A.

Federal Telephone and Radio Company

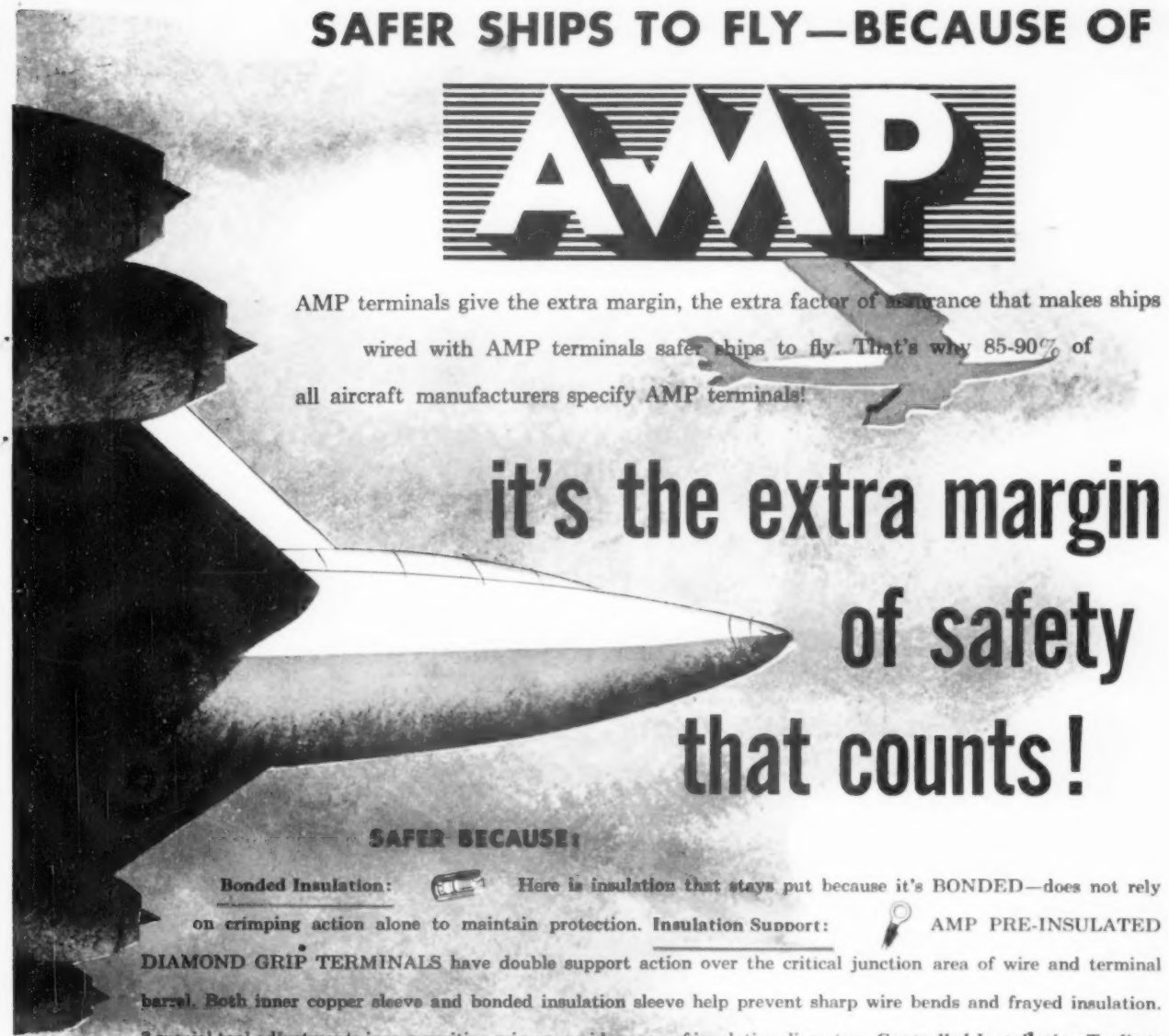
SELENIUM-INTELIN DEPARTMENT **100 KINGSLAND ROAD, CLIFTON, N. J.**

In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., N. Y.

SAFER SHIPS TO FLY—BECAUSE OF

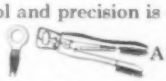
AMP

AMP terminals give the extra margin, the extra factor of assurance that makes ships wired with AMP terminals safer ships to fly. That's why 85-90% of all aircraft manufacturers specify AMP terminals!



it's the extra margin of safety that counts!

SAFER BECAUSE:

Bonded Insulation: Here is insulation that stays put because it's BONDED—does not rely on crimping action alone to maintain protection. **Insulation Support:** AMP PRE-INSULATED DIAMOND GRIP® TERMINALS have double support action over the critical junction area of wire and terminal barrel. Both inner copper sleeve and bonded insulation sleeve help prevent sharp wire bends and frayed insulation. 3 special tool adjustments insure positive grip over wide range of insulation diameters. **Controlled Installation Tooling:** AMP *CERTI-CRIMP*® HAND TOOLS are designed to make every terminal application never too tight and always tight enough. This exacting, pre-determined crimp is the secret of AMP'S outstanding performance. Jaw dies (gauged to ± .003) close with exactness every time, and the same control and precision is obtainable whenever you use AMP hand tools or AMP automatic machines! **Dot and Color Coding:**  AMP *PRE-INSULATED DIAMOND GRIP*® TERMINALS AND TOOLS are color matched to insure proper combination. AMP dot coding "brands" each application so you know that the right team has been used together. **Speed of Application:**

AMP AUTOMATIC WIRE TERMINATORS will help keep your wire preparation up to schedule. 1200 to 1800 PRE-INSULATED® type terminations per hour are not unusual with these machines!

AMP

AMP Trade-Mark Reg. U.S. Pat. Off.
®Trade-Mark

AIRCRAFT MARINE PRODUCTS, INC.
2100 Paxton Street, Harrisburg, Pennsylvania

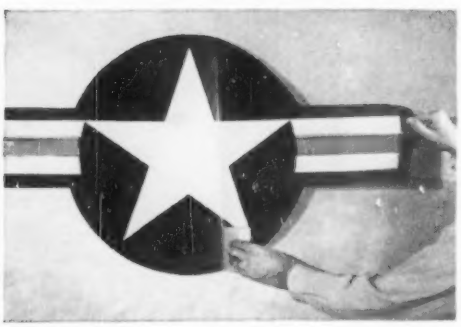
AIRCRAFT MARINE PRODUCTS OF CANADA, LTD.
1764 Avenue Road, Toronto 12, Ontario, Canada

Tomorrow's Planning Today
WHEN YOU LET WEBER Airgineering
WORK FOR YOU!
Whether you require today's known needs or are anticipating tomorrow's requirements, our planning and development engineers are ready to serve you.
From design to delivery is Weber's way of completely handling your air-borne equipment project . . . and you save in time and money, too, for we assume complete responsibility for research, design and modern production methods.
Why not take advantage of Weber's "Design-to-Delivery" service? Let us help you on *your* air-borne equipment problems. Call or write today.
WEBER AIRCRAFT CORPORATION
2820 Ontario Street • Burbank, Calif. • CHarleston 8-5543
Subsidiary of Weber Showcase & Fixture Co., Inc.
BUFFET

New, tougher marking material passes supersonic adhesion test with flying colors!

In use on the latest and fastest supersonic fighters and test planes!

"SCOTCHCAL" Film No. 650 — an extremely tough marking material—saves both time and money on marking jobs; gives longer lasting, more attractive markings for any plane—private, commercial, or military. Exclusive adhesive feature lets you apply numbers and markings in minutes instead of hours. And the firm-bonding adhesive doesn't let go—keeps markings of "SCOTCHCAL" Film fresh and intact for many times the life of ordinary decals . . . even in severe weather . . . even at supersonic speeds!



EASY TO APPLY. Simply strip off adhesive protector; activate and apply. No drying time. Colors are true, brilliant, eye-catching. Pre-cut letters, numbers, and standard borders and designs available. This is time-saving, labor-saving, *cost-saving* marking!

SPECIAL HEAVY DUTY MATERIAL (NO. 455)... won't rub off . . . won't erode when applied to leading edges, walkways or speed-heated skins of supersonic craft!

Send for FREE SAMPLE

Reg. U.S. Pat. Off.

SCOTCHCAL
BRAND
FILM

Made in U.S.A. by Minnesota Mining and Mfg. Co., St. Paul 6, Minn. "Scotch" Brand pressure-sensitive tapes • "Scotch" sound recording tape • "Underseal" rubberized coating • "Safety-walk" non-slip surfacing • "3M" abrasives • "3M" adhesives • General Export: 122 E. 42nd St., New York 17, N. Y. In Canada: London, Ont., Can.

MINNESOTA MINING & MFG. CO.
Dept. AW-34
St. Paul 6, Minn.

Please send me a sample of "SCOTCHCAL" Film with application information.

NAME.....

COMPANY.....

ADDRESS.....

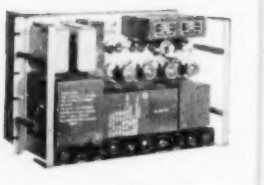
.....

VHF for air-ground communications?

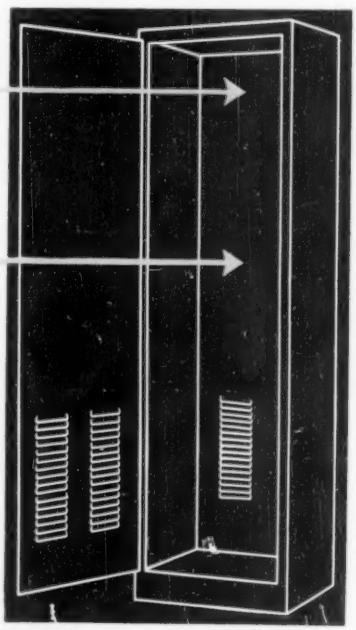
dependable . . . flexible . . . versatile . . .
COLLINS 242F-3 GROUND STATION TRANSMITTER
for complete VHF Coverage . . . local or remote

108 to 152 mc. Rated at 50 watts RF output into 52 ohms. Normally supplied with power supply/modulator unit and one RF unit. Extra RF units (for non-simultaneous operation) can be added as required to a common power supply/modulator. Each RF unit has provision for two crystals and is equipped with a selector switch allowing a pair of channel frequencies up to 0.3% separation without retuning. Up to four RF units (eight channel frequencies) can be remotely operated by the Type 278E-1 Remote Control Unit. An unlimited number of RF units can be locally controlled. All units designed for 19" rack mounting. Power requirements: 115/230 volts, 50/60 cps, single phase. 800 watts transmit, 100 watts standby.

RF UNIT — Tubes, transformers, and controls are accessible from the front. Under-chassis wiring is accessible from the rear by the removal of the protective cover. Vertical type chassis construction is employed with the tubes and transformers mounted horizontally. There is a sub-chassis for the oscillator, frequency multiplier and driver, and a sub-assembly for the final amplifier. This type of construction allows nearly ideal heat dissipation thus providing cooler running equipment for longer service life.



POWER SUPPLY/MODULATOR — As in the RF unit, tubes and controls are accessible from the front. Under-chassis wiring is accessible from the rear after removal of the protective cover. Vertical type chassis construction is employed with tubes and transformers mounted horizontally.



51M-7 VHF RECEIVER — COMPANION to 242F Transmitters

Frequency Range: 118.0 to 152.0 mc.
Sensitivity: Signal to noise ratio for a 5 microvolt input signal modulated 30% is not less than 10 db.*
Selectivity: Bandwidth at 6 db attenuation is not less than 45 kc. Bandwidth at 60 db attenuation is not more than 140 kc.
Automatic Volume Control: Audio output will not vary more than 3 db when the input signal is varied from 5 to 100,000 microvolts.
Input Circuit: Impedance 52 ohms unbalanced.
Output Circuit: Impedance 600 ohms split secondary winding with 4 ohm tap for speaker voice coil operation.
Output Level: Not less than 2.0 watts for 5 microvolt input signal modulated 30% at 1000 cps.
Audio Frequency Response: Audio output from 300 to 3500 cps does not vary more than 3 db from audio output at 1000 cps.
Audio Distortion: Does not exceed 10% when measured at 2.0 watts output with signal modulated 30% at 1000 cps.
Spurious Responses: All spurious responses are attenuated at least 90 db with respect to desired signal.
Ambient Temperature Range: −40°C. to +60°C.
Ambient Humidity Range: 0 to 95% relative humidity.
Altitude: Sea level to 10,000 feet.
Frequency Stability: 0.005% over the specified service conditions.
Power Source: 115 v. or 230 v. 50-60 single-phase a-c.
Dimensions: Width 19", height 8¾", depth 10¾".
Weight: Approx. 26 lbs.

*Input signals specified are signal voltages in series with 52 ohms, measured with open circuit.

COLLINS...OF COURSE!

When your problem is the selection of ground station VHF equipment . . . consider Collins quality, versatility and dependability

FOR EXTRA POWER
200 WATT 242F-2 Transmitter

Ambient Temperature Range: —40°C to +60°C.

Ambient Humidity Range: 0 to 90% relative humidity.

Altitude: Sea level up to 7000 feet.

Power Source: The unit operates from 105-115/210-230 v ac 50/60 cycles, single phase with a standby power requirement of 200 watts and a transmit power requirement of 1300 watts. It operates with a power factor of 90% lagging. The unit can be operated from 115 v ac with two primary windings on transformer connected in parallel or on 230 v ac with these windings in series. Low voltage taps are also provided on all transformers.

Frequency Range: 108 to 152 megacycles.

Channels: Single channel transmitter with desired output frequency determined by crystal frequency selection. A second frequency can be installed without retuning with the requirement that the channel separation shall not be more than 0.3% of operating frequency. This spacing will reduce power no greater than 0.5 db.

Frequency Stability: ± 0.001%.

Harmonics and Other Spurious Production: All spurious radiation, including harmonics, are at least 80 db below carrier level when used with the 35D-1 filter supplied with transmitter.

Audio Input: 100 ohm carbon microphone with push-to-talk switch or a high impedance dynamic microphone with push-to-talk switch. Dynamic microphone is recommended because of superior frequency response.

Modulation: At least 90% modulation is obtained from 300 to 3750 cps or 300 to 10,000 cps depending on application.

Audio Frequency Response: Flat to ± 3 db with respect to 1000 cps over a range of 300 to 3750 cps. This is measured at a level for 90% modulation without clipping.

Power Output: At least 200 watts is delivered over frequency limit and service conditions when operating into a 52 ohm resistive load.

Carrier Shift: Power output decreases less than 10% over the range of 0 to 90% modulation.

Output Impedance: 52 ohms.

Noise Level: Better than 40 db below 90% modulation without clipping.

RF Unit: 19" wide, 12¼" high and 12" deep.

Modulator Unit: 19" wide, 14" high and 12" deep.

RF Selector Unit: 19" wide, 7" high and 8" deep.

Filter and Bias Unit: 19" wide, 10½" high and 12" deep.

50 WATT 242F-3
VHF Ground-Station Transmitter

Ambient Temperature Range: —40°C to +60°C.

Ambient Humidity Range: 0 to 90% relative humidity.

Altitude: Sea level up to 7000 ft.

Power Source: The unit operates from 105-115/210-230 v ac, 50/60 cycles, single phase with a standby power of 100 watts and a full load transmit power requirement of 800 watts. It operates at a power factor of 90% lagging. The unit can be operated from 115 v ac with two primary windings on the transformer connected in parallel or on 230 v ac with these windings in series.

Frequency Range: 108 to 152 megacycles.

Channels: This is a single channel transmitter with desired output frequency determined by crystal frequency selection. A second channel is provided with the requirement that the channel separation shall not be more than 0.3% of operating frequency, without retuning.

Frequency Stability: The crystals utilized are mounted in a temperature stabilized oven so that a frequency stability of ± 0.001% is obtained under any natural combination of the service conditions.

Harmonics and Other Spurious Production: All spurious radiation, including harmonics, are at least 80 db below carrier level when used with the 35D-1 filter supplied with transmitter.

Modulation: High level amplitude modulation is obtained through use of a plate and screen modulation transformer. 90% modulation is obtained from 300 to 3750 cps, or 10,000 cps depending on application.

Power Output: At least 50 watts is delivered over frequency limit and service conditions when operating into a 52 ohms resistive load.

Carrier Shift: Less than 10%.

Output Impedance: 52 ohm.

Audio Input: A microphone input circuit is designed to operate from a carbon microphone or a dynamic high impedance microphone. A 600 ohm balanced audio line is also provided for remote operation.

Audio Frequency Response: The audio frequency response of the unit is flat to ± 3 db with respect to 1000 cps over a range of 300 to 3750 cps.

Audio Frequency Distortion: The audio frequency distortion is less than 10% with a modulation level of 90%.

Noise Level: Better than —40 db.

Contact the Collins office nearest you for complete technical details and information. Compare specifications before you buy and you'll buy Collins.

FIRST in service to the aviation industry.

COLLINS RADIO COMPANY CEDAR RAPIDS, IOWA

11 W. 42nd Street, NEW YORK 36 | **1930 Hi-Line Drive, DALLAS 2** | **2700 W. Olive Avenue BURBANK**

It takes a tough, heat-resistant bolt to withstand the temperatures of modern jet engines. Today, The H. M. Harper Company is manufacturing bolts, nuts, and other fastenings of the modern high temperature alloys such as Discaloy, Refractaloy, A-286, and special grades of stainless steel. If you require fastenings designed to withstand high temperatures, corrosion, excessive wear, or other extreme conditions, Harper engineers and metallurgists will gladly assist you.

For over a quarter of a century, The H. M. Harper Company has specialized in the manufacture of corrosion-resistant fastenings in brass, naval bronze, silicon bronze, monel, aluminum, and all stainless steels, and is today America's largest producer of such fastenings.

THE H. M. HARPER COMPANY
AERO DIVISION
8200 Lehigh Avenue, Morton Grove, Ill.

Specialists in High Temperature Fastenings of—

Refractaloy
A-286
Inconel
Discaloy
Hastelloy
19-9-DL
Greek Ascaloy
Titanium
Stainless Steel

Behind the PLEXIGLAS...

Behind every transparent enclosure of PLEXIGLAS—canopies on jet fighters and bombers; noses on helicopters; windows of transports; astradomes and gun turrets—is a background of care and experience.

In Rohm & Haas Company plants, exacting physical tests insure that the properties for which PLEXIGLAS acrylic plastic is so noted—clarity, formability, strength, resistance to weather—are maintained during large scale production.

Equally important is the processing care and know-how of companies in whose plants PLEXIGLAS sheets are formed and fabricated into enclosures that are clear, strong, sound, and worthy of the trust of aircraft pilots and passengers.

Back of Rohm & Haas Company's manufacturing skill lie years of experience as the supplier of aviation's standard transparent plastic . . . years marked by the continuing development of improved grades of PLEXIGLAS to meet the requirements of faster, higher-flying planes.

CHEMICALS FOR INDUSTRY

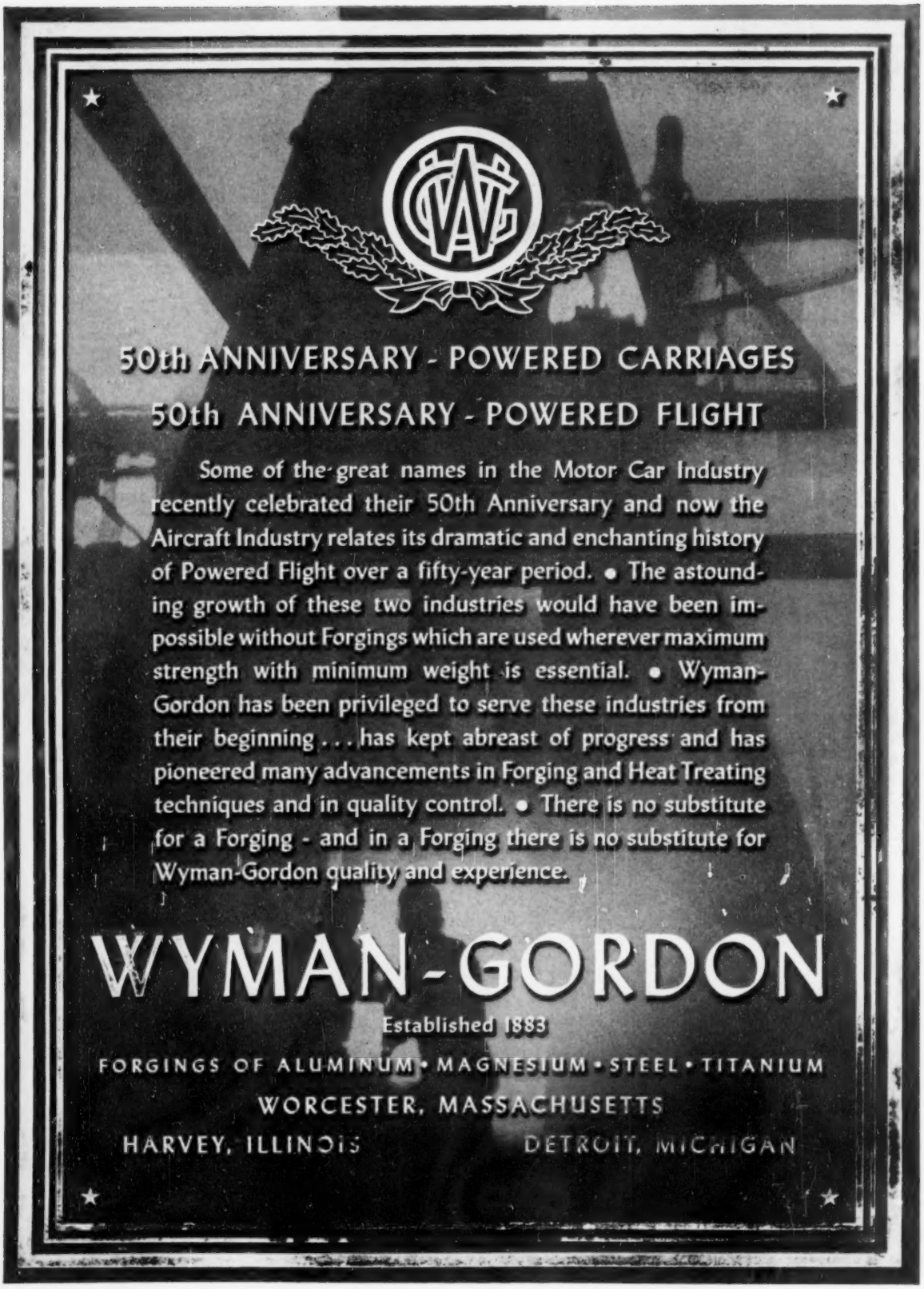
ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

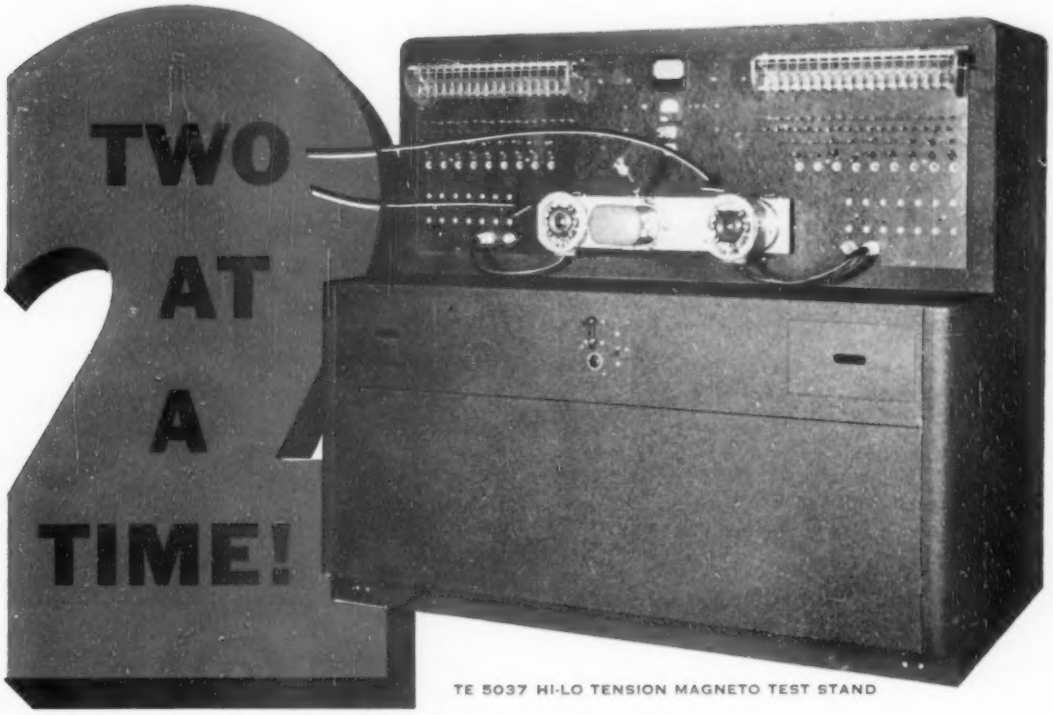
Canadian Distributor: *Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis St., Toronto, Ontario, Canada*

PLEXIGLAS is a trademark, Reg. U.S. Pat. Off. and other principal countries in the Western Hemisphere.


50th ANNIVERSARY - POWERED CARRIAGES
50th ANNIVERSARY - POWERED FLIGHT
Some of the great names in the Motor Car Industry recently celebrated their 50th Anniversary and now the Aircraft Industry relates its dramatic and enchanting history of Powered Flight over a fifty-year period. • The astounding growth of these two industries would have been impossible without Forgings which are used wherever maximum strength with minimum weight is essential. • Wyman-Gordon has been privileged to serve these industries from their beginning . . . has kept abreast of progress and has pioneered many advancements in Forging and Heat Treating techniques and in quality control. • There is no substitute for a Forging - and in a Forging there is no substitute for Wyman-Gordon quality and experience.
WYMAN-GORDON
Established 1883
FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM
WORCESTER, MASSACHUSETTS
HARVEY, ILLINOIS
DETROIT, MICHIGAN

TEST ANY MAGNETO

R-985 to R-4360...hi- or lo-tension



TE 5037 HI-LO TENSION MAGNETO TEST STAND

Here's savings spelled out in dollars! Here's *one* test stand that will replace a whole shop full of miscellaneous magneto test units. *In pairs* or singly, you can test *any* magneto regardless of size...test *any* magneto whether high tension or low tension!

Finger-tip controls...handy work table area...amazing freedom from vibration... PAC's famous built-to-take-it easy maintenance construction! Modernize with a TE 5037 Hi-Lo Tension Magneto Test Stand now! You'll speed up every magneto job, you'll save money and valuable shop space, too!

Manufacturing Division

Dimensions: 5' 7½" high; 3½' wide; 6½' long.
Shipping weight approximately 1200 pounds.

Write for PAC's new Equipment brochure. It describes test and ground handling equipment that has the whole industry talking!

Pacific Airmotive Corporation

Other Divisions: Chino and Oakland, California • Seattle, Washington • Kansas City, Kansas • Linden, New Jersey

2940 North Hollywood Way
Burbank, California

To keep pace with the growing need for completely reliable aircraft instrumentation and control components, the Aircraft Products Division of Manning, Maxwell & Moore, Inc. is now manufacturing in three strategic locations: Stratford and Danbury, Connecticut and Inglewood, California.

The expansion and dispersal of our facilities greatly augments the availability of our design, engineering, testing and production facilities. Whether your responsibilities concern the application of aircraft pressure switches, electronic amplifiers, hydraulic valves or turbojet engine control systems, we can now serve you better than ever before. Whatever the dimensional and functional requirements of such vital components, our unique design technique eliminates all compromise with performance. For we recognize that compatibility between airframe and equipment is the key to the success of the weapons system of the U. S. Air Force, as well as the continued leadership of the nation's air transportation industry.

We believe the counsel of our engineering specialists can contribute appreciably to the safety and dependability of today's most advanced aircraft and those you are now developing. Your inquiry is invited.

MANNING, MAXWELL & MOORE, INC.

AIRCRAFT PRODUCTS DIVISION • STRATFORD, CONN. • DANBURY, CONN. • INGLEWOOD, CALIF.

OUR AIRCRAFT PRODUCTS INCLUDE: TURBOJET ENGINE TEMPERATURE CONTROL AMPLIFIERS • ELECTRONIC AMPLIFIERS PRESSURE SWITCHES FOR ROCKETS, JET ENGINE AND AIRFRAME APPLICATIONS • PRESSURE GAUGES THERMOCOUPLES • HYDRAULIC VALVES • JET ENGINE AFTERBURNER CONTROL SYSTEMS.

Specialized fasteners by Monadnock

★ SPEED ASSEMBLY

★ GIVE TROUBLE-FREE PERFORMANCE

★ EASE MAINTENANCE

With a wealth of experience in working with leading aircraft manufacturers across the country, Monadnock is fully equipped to design specialized fastening devices to meet your particular requirements and to produce them in volume.

SOL-A-NUT
Heat Resistant
Stainless Steel Nut

WEDJIT
Seat and Cargo
Tie-down Fastener

AIRLOC
Cowling and
Panel Fastener

WIRE HARNESS BAND
Non-chafing
Snap-locking Clamp

MONADNOCK MILLS

San Leandro, California

Subsidiary of UNITED-CARR FASTENER CORP.

THIS IS WHY

WE SAY OUR CUSTOMER LIST
READS LIKE WHO'S WHO
IN AMERICAN INDUSTRY.

BREEZE MARK

Beechcraft

HAMILTON STANDARD

Cessna

Bendix
AVIATION CORPORATION

CURTISS WRIGHT CORPORATION

SUNDSTRAND

AM gears, INC.
ACCURATELY MADE
A SUBSIDIARY OF HUPP CORPORATION

CLEVELAND • DETROIT
CHICAGO

2 BIG PLANTS • AIR-SPEC GEARS AND GEAR ASSEMBLIES

CHICAGO 6633 WEST 65TH STREET, CHICAGO 38

DETROIT 7450 MELVILLE, DETROIT 17

FLAME-PROOF FABRIC CONNECTOR ELIMINATES "fire zone" fatigue

CASE HISTORY

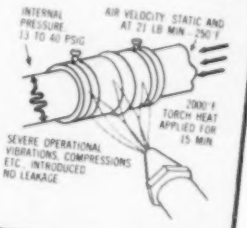
ARCOSIL RUBBER IMPREGNATED FIBERGLASS CONNECTOR PERFORMS AFTER 2000° FIRE TEST

To eliminate fatigue failures of metal connectors on aircraft supercharger intake ducts, Arrowhead designed a replacement part from ArcoSil silicone rubber fiberglass material. Tests were made to determine fire-resistant and fire-proof characteristics of supercharger inlet duct connector.

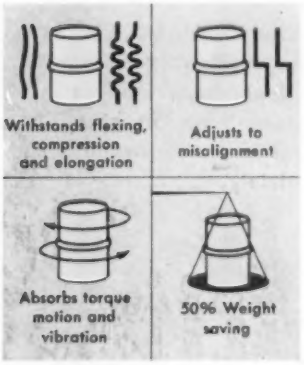
TEST CONDITIONS: Required to withstand 2000° F. flame for 15 min. Pressure: 13 PSIG. Internal air flow: static and 21 lb./min. at 250° F. internal air temperature.

RESULT: After severe flexing, conductor withstood 40 PSIG pressure with no leakage.

C.A.A. APPROVED.


INTERNAL PRESSURE 13 TO 40 PSIG
AIR VELOCITY STATIC AND AT 21 LB MIN - 250 F
2000° F TORCH HEAT APPLIED FOR 15 MIN
SEVERE OPERATIONAL VIBRATIONS, COMPRESSIONS ETC., INTRODUCED
NO LEAKAGE

ArcoSil connector replaces metal on supercharger intake duct


Withstands flexing, compression and elongation
Adjusts to misalignment
Absorbs torque motion and vibration
50% Weight saving

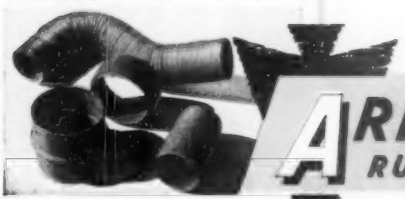
ARCOSIL FIBERGLASS DUCTING OFFERS *NEW* DESIGN APPLICATIONS

New techniques developed by Arrowhead in fabricating complex ducts, sleeves and couplings from ArcoSil flexible silicone rubber impregnated fiberglass have opened amazing new design possibilities. In addition to ArcoSil's ability to withstand heat, vibration and torque-motion-fatigue, the materials permit the parts to be formed to almost any conceivable shape and size to meet individual specifications.
A variety of standard constructions offers serviceability under extreme high and low temperatures and at various pressures.

Close tolerance tooling and production costs are cut to a fraction, as compared with metal, to effect sizeable savings in either experimental or production quantities. Up to 50% weight reduction is possible.
Flexibility permits crushing without damage and simplifies installation.

Arrowhead specializes in solving difficult flex-connector problems in fuel, oil and air systems. Arrowhead field engineers will gladly provide further information and assistance.

WRITE FOR ENGINEERING BULLETIN
describing complete line of ducts, sleeves and couplings.



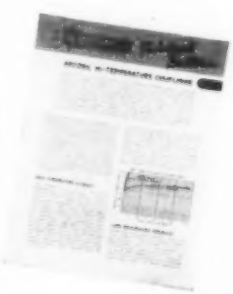
Many types and sizes

ARROWHEAD RUBBER COMPANY

Division of Richard Mohr Jewelry Company, Inc.

2340 CURRY STREET, LONG BEACH, CALIFORNIA

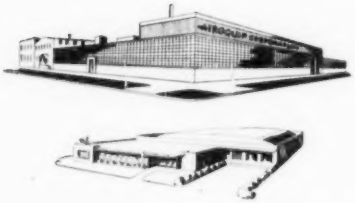
Pioneer fabricators of silicone rubber; Originators of rubber-fiberglass ducting



WHY Aeroquip

FIRST IN PRODUCT DEVELOPMENT—You can meet your fast-changing aircraft plumbing requirements easily and quickly by calling on Aeroquip's outstanding research and engineering facilities. Aeroquip's top notch engineering team starts with your basic problem . . . then designs, tests and produces the products that provide the solution.

FIRST IN QUALITY—Aeroquip maintains uniformly high quality standards with an exacting system of quality control. Component materials, workmanship and finished products are constantly checked with precisely accurate inspection equipment . . . your assurance that Aeroquip products will perform with maximum efficiency.



FIRST IN SERVICE—The Aeroquip plant in Jackson, Michigan, and the Aero-Coupling plant in Burbank, California, offer two dependable sources for Aeroquip products and service. Both are strategically located to serve aircraft industrial centers quickly, conveniently, and completely.

Aeroquip

AEROQUIP CORPORATION, JACKSON, MICHIGAN
AERO-COUPLING CORPORATION, BURBANK, CALIFORNIA
(A Subsidiary of Aeroquip Corporation)

Manufacturers of Aeroquip Flexible Hose Lines with detachable, reusable Fittings; Self-Sealing Couplings; Brazed Aluminum Elbows

LOCAL REPRESENTATIVES IN PRINCIPAL CITIES IN U.S.A. AND ABROAD • AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

A DIVISION OF GENERAL METALS CORPORATION

SOLENOID OPERATED
SHUT-OFF VALVE WITH RELIEF

ADEL control is the vital element

ADEL research, design, engineering and production are being applied to automatic as well as manual *control* problems of aircraft.

ADEL is a veteran in the manufacture of Aircraft Hydraulic and Pneumatic Control Equipment, Heater, Anti-Icing and Fuel System Equipment and Engine Accessories.

ADEL's long experience, together with the highest quality standards, is responsible for the fact that aircraft the world over depend on ADEL components for safe, efficient performance.

Uniform protection . . . Uniform safety . . .
Uniform dependability . . . With ADEL

BURBANK, CALIFORNIA • HUNTINGTON, WEST VIRGINIA
CANADA: RAILWAY & POWER ENGINEERING CORPORATION, LIMITED

BARBER COLMAN

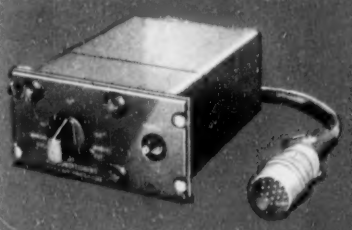
Aircraft Controls

custom-engineered or standard types for a wide range of control needs on today's complex aircraft and missiles

Since the early Thirties, Barber-Colman Company has been designing and manufacturing controls specifically for aircraft applications.

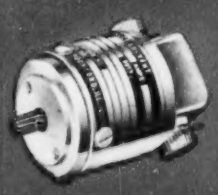
Throughout the most important period in aviation's advancement, Barber-Colman engineers have closely co-operated with major airframe and equipment manufacturers, the military, and all leading airlines. As a result they have acquired a thorough and very special knowledge of those factors in aircraft design which determine and limit the function, size, weight, *and performance* of accessory equipment.

Applications for Barber-Colman aircraft controls range from basic remote positioning to sequence operation of complex air conditioning systems . . . with either custom-engineered or standard type controls as required by the specific applications involved.



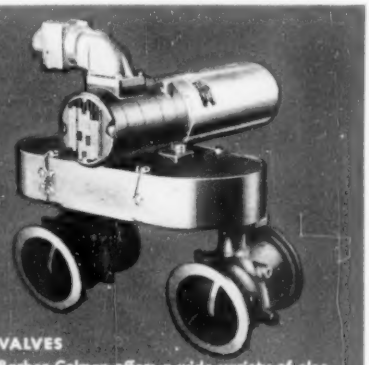
TEMPERATURE CONTROLS

Illustrated is Barber-Colman's latest electronic control assembly. For use in a jet fighter, it incorporates relay and amplifier unit, selector control, and override switches in one panel-mounted assembly. Barber-Colman offers complete coverage of the automatic temperature control field—electric, electronic, cycling, proportioning.



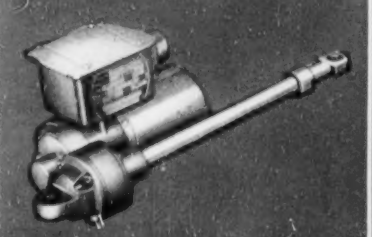
MOTORS

Small permanent-magnet and split-series d-c motors with true electrical balance, 25% higher efficiency, superior commutation, exceptionally low radio noise, and outstanding constructional features. Gear head versions offer wide selection of gear ratios.



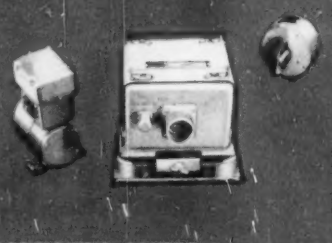
VALVES

Barber-Colman offers a wide variety of electrically actuated air valves for use with temperature and pressure control applications. This dual 2" valve assembly solved a difficult sequencing problem.



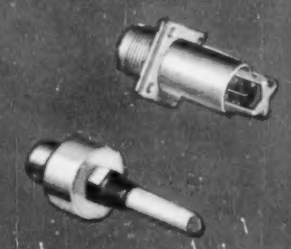
ACTUATORS

Rotary and linear types. These Barber-Colman actuators combine gear reductions, switching, mounting details, and other design features to meet most aircraft applications in their load-speed class.



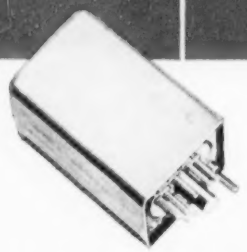
POSITIONING CONTROLS

Completely integrated high-speed positioning control system inclusive of transmitting rheostat, d-c nonelectronic control box, and remote actuator. Unique circuitry provides anti-hunt feature.



THERMO-SENSITIVE ELEMENTS

Complete line of thermo-sensitive wire and thermistor sensing elements. New ceramic duct element provides solution to environmental extremes encountered in jet aircraft. Extremely fast response, withstands 800° F.



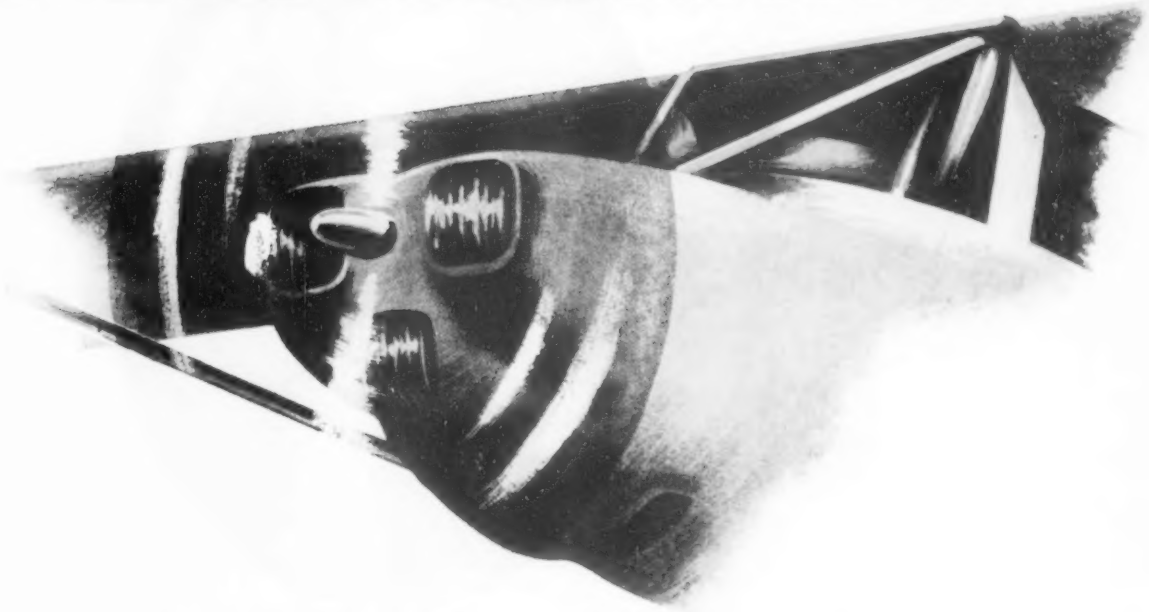
ULTRA-SENSITIVE RELAYS—Available in sensitivities from 50 microwatts to 1 milliwatt. Wide range of coils, enclosures, mounting details. Extensively used in balance detecting bridge circuits and as plate current relay in electronic applications. New type HVO offers savings in chassis mounting space.

Typical applications for Barber-Colman aircraft controls are: temperature control of cabin, cockpit, cargo, camera and electronic compartments . . . hot air or electrically heated windshields . . . wing and empennage anti-icing, and carburetor air . . . positioning of trim tabs, valves, throttles . . . flap unbalance detection . . . nose wheel steering . . . and hundreds of other applications. For data on Barber-Colman aircraft controls, write for Catalog F4141. Engineering sales offices in Los Angeles, Seattle, Baltimore, New York, Montreal.

BARBER-COLMAN CO., DEPT. C, 1422 ROCK ST., ROCKFORD, ILL.

Aircraft Controls • Automatic Controls • Industrial Instruments • Small Motors • Air Distribution Products • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

PERFORMANCE !



The slogan, "More people ride on Goodyear tires than on any other kind," revealingly stresses multiple output even in this day of mechanical marvels. Comparably . . . more pilots become air-borne, for business and recreation through the far-sighted planning of this great company than from any other single source. Complementing the prolific results of such creative and production genius, Air Associates has built its own unique place of leadership by more than a quarter century of service in distributing these, and allied products. Today . . . the list of key manufacturers whom we represent is indeed a blue ribbon roster of the aviation equipment industry. Conscious of our own responsibility, and mindful of our heritage as an integral part of aviation . . . we pledge every resource at our command to the creating and distributing of the finest aviation equipment the world has ever known.

"DO MORE BUSINESS . . . MAKE MORE PROFIT WITH AIR ASSOCIATES' EQUIPMENT"

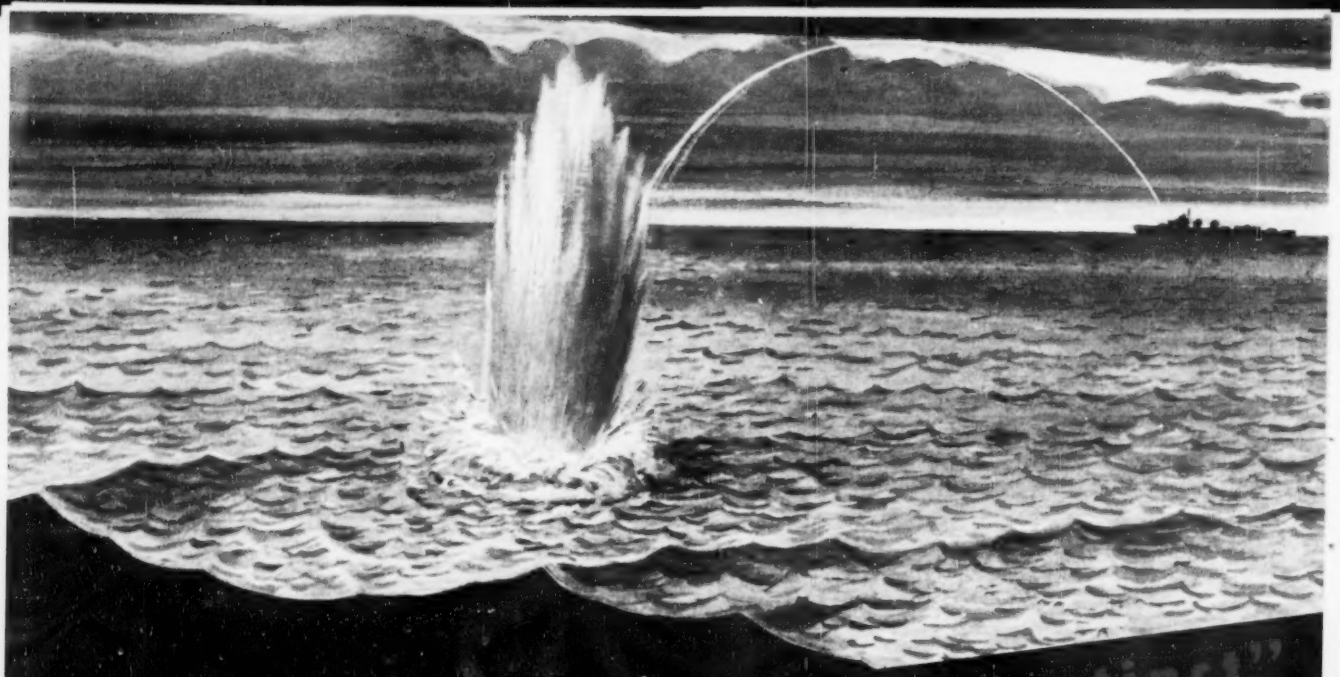
J. E. Lashman

PRESIDENT

AIR ASSOCIATES, INC.

TETERBORO, NEW JERSEY

DIVISIONS: ATLANTA • CHICAGO • DALLAS • GLENDALE • HACKENSACK • MIAMI • ORANGE • TETERBORO



"killer instinct"

Almost by "instinct," tomorrow's missiles will seek out and destroy submerged subs. Controlling weapons and providing them with "instinct" typifies systems made by Arma Corporation.

Arma Corporation, Brooklyn, N.Y.; Garden City, N.Y.
Subsidiary of the American Bosch Corporation.

ARMA ADVANCED ELECTRONICS FOR CONTROL

Arma is a good place to work

■ CONTENTS

AVIATION WEEK

Volume 60 No. 11
March 15, 1954

TWENTY-FIRST ANNUAL "INVENTORY OF AIRPOWER"

■ NEW AIRPOWER DOCTRINE..... 38

■ U. S. AIR FORCE
Air Force Takes Key Role in U.S. Policy..... 45

■ U. S. NAVY
Naval Aviation Makes Rapid Progress..... 56

■ U. S. ARMY
Army Puts New Stress on Air Mobility..... 65

■ COLOR PHOTO PORTFOLIO
New U.S. Military and Research Planes..... 40

■ NATO
Airpower is the West's Weakest Link..... 75

■ GUIDED MISSILES
Planners Weigh Cost of U.S. Program..... 78

■ RUSSIA
Reds Put Muscle on Strategic Air Arm..... 90

■ MANUFACTURING
New Doctrine Aims to Stabilize Industry.....101

■ AVIONICS
New Techniques Buttress Avionics Role.....111
New ANDB May be Key to Progress.....125

■ BUSINESS FLYING
Multi-Million Market Goes Begging.....136

■ HELICOPTERS
Military Success Spurs Civil Interest.....142

■ HUMAN FACTORS
Man-Machine Teamwork is Key to Best Use of Weapons Systems.....154

■ TRANSPORT
Air Transport Records its Biggest Year.....160
MATS Operations Set for Peace or War....172
Airfreight Faces Uphill Fight.....182

■ ENGINEERING
Speeds Get Higher, Problems Tougher.....187

■ SPECIFICATION TABLES
U.S. Guided Missiles..... 80
U.S. Research Planes 195
U.S. Military Planes 196
U.S. Business and Personal Planes.....198
U.S. Civil and Military Transport Planes....200
U.S. Helicopters 205
Russian Aircraft 206
Foreign Aircraft 208
Foreign Helicopters 214
U.S. Piston Engines 216
U.S. Gas Turbines 220
Foreign Gas Turbines.....222

■ FOREIGN AIRPOWER
Great Britain: Airpower Balances on Budget Tightrope 226
France: Off-Shore Buying Props Ailing Industry 234
Canada: Rushes Defense Net, Aids NATO...262
Japan: Plenty of Talk, Not Much Action....272
West Germany: Aviation Marks Time Till EDC Ratification 280
Italy: Aviation Falls Short of Earlier Promise.288
Spain: U.S. Aid Starts Wheels Turning.....294
Australia: Australian Aviation to Push Modernization 296
Netherlands: Dutch Air Strength Ahead of Schedule 307
Sweden: Defense is Spread Thin.....312

■ STATISTICS
USAF Planes on Hand..... 50
Major USAF Commands..... 50
USAF Plane Types on Order..... 50
Active Military Plane Inventory..... 52
U.S. Navy Aircraft on Hand..... 56
U.S. Navy Plane Types on Order..... 60
U.S. Scheduled Air Transport Industry, 1953..163
World Air Traffic Gains, 1937-1953.....164
Military Plane Speed Records.....187
Research Plane Speed Records.....187
Military Aircraft Appropriations and Expenditures, 1935-1955 220
British Jet Transports Ordered to Date.....234
Major Canadian Aircraft Plants.....266
Shipments by Plants of Complete Civil Aircraft and Engines 316
U.S. Aircraft Industry Plant Data, Backlogs..316
News of the Week.....319
Advertisers Index.....349

■ EDITORIAL INDEX 328

AVIATION WEEK
A McGRAW-HILL PUBLICATION

Industry Will Maintain Peak...

This will be another good year for aviation. Sales volume for manufacturers of airframes, engines, parts and accessories will climb about 10% over the postwar record $9-billion sales total for 1953. Major trunk airlines will boost gross revenues and net incomes but trouble looms ahead for local service lines and nonscheduled operators.

The electronics industry sold $3 billion worth of military equipment in 1953, mostly avionics. This year will see further expansion of both military and commercial avionics markets. Guided missiles development and manufacturing, already approaching the rank of a billion-dollar industry, will operate at about its 1953 level for the foreseeable future. No really large-scale production of missiles is in sight until major development obstacles are hurdled.

COMMERCIAL MARKET

HELICOPTER MANUFACTURING and operations will expand during 1954 with increasing emphasis on commercial products. Both the 30-40-passenger transport helicopters and the smaller 4-6-place designs aimed at a variety of industrial and agricultural applications will enter the commercial market during 1954.

Utility aircraft production should remain steady at a 1,000-plane level during 1954. Main effort will be devoted to twin-engine equipment aimed at the expanding business flying market. Most of these trends should carry into 1955.

THE NEW DOCTRINE

KEY TO THE FUTURE of the aviation market, at least for the next three years, is the new airpower doctrine formulated during the closing months of 1953 by the National Security Council and endorsed by President Eisenhower. It is the blueprint for both military and civil aviation policy during the three remaining years of the President's current term. Its military application resulted in the "new look" for U. S. strategic policy now being implemented by the Defense Department. Details of the new doctrine's civil application are now being studied by the Air Coordinating Committee in preparation of a detailed policy to be submitted to President Eisenhower. From the committee's study will emerge a new civil aviation policy to match its military counterpart.

The new strategic doctrine calls for building and maintaining two specific types of military forces. First, a force capable of swift and devastating retaliation for any major aggression. Second, mobile task forces that can function as a military "fire department" hurrying to any point on the globe to extinguish minor aggression.

DEVASTATING RETALIATION

AIRPOWER WILL DOMINATE both types of forces. For the swift and devastating retaliation deep in the enemy's heartland, the new defense doctrine will rely on atomic and hydrogen weapons delivered by the long-range bombers of the Air Force's Strategic Air Command. For the fire department task forces, airpower is required to provide the mobility to rush them to the scene of the emergency and the heavy punch necessary to blast out the fire.

The National Security Council has made it clear both to the Defense Department and to foreign nations that U. S. airpower will use atomic weapons against military targets to counter any type of future aggression. It is apparent that top policy makers have learned a lesson from the failure to use tactical atomic weapons against the Chinese Communist armies during the early phases of their aggression in Korea.

ADM. ARTHUR W. RADFORD, chairman of the Joint Chiefs of Staff, also has made it clear that any discussions on maintaining superior United States airpower are based on a concept of national airpower that includes not only military aviation of the Air Force, Navy, Army and Marines, but also civil aviation resources such as the commercial airlines and the aircraft manufacturing industry.

This strategic doctrine is a new concept and its

"Today there is no argument among military planners as to the importance of airpower. Offensively, defensively and in support of other forces it is a primary requirement. Its strength continues to grow, both through increases in combat units and through better equipment. . . .

"The President of the United States, the Secretary of Defense, and the Joint Chiefs of Staff are of one mind on this matter: This nation will maintain a national airpower superior to that of any other nation in the world."

—Admiral Arthur W. Radford, USN, Chairman, Joint Chiefs of Staff

implementation in regard to airpower has only begun. First effects on our national airpower have been good. The Air Force will continue its expansion program toward a goal of 137 combat wings and an active inventory of some 22,000 modern aircraft by 1957. Naval aviation will maintain its combat strength of 16 carrier air groups plus supporting anti-submarine, patrol and transport squadrons to achieve an inventory of 9,000 modern aircraft by 1957. Army will continue its expansion of airpower to exploit the mobility of vertical envelopment. Marines will maintain three modern air wings plus a helicopter fleet for air assault.

THE MOST SERIOUS WEAKNESS apparent so far in the military implementation of the new strategic doctrine is the lack of sufficient air transport to provide the Army with the long-range mobility it must have to do a more effective job with fewer men. However, a major reorganization of military air transport has been boiling in the Pentagon and this may solve this critical airlift problem soon.

'AGE OF PERIL'

UNDER THE NEW STRATEGIC DOCTRINE United States military strength is being built primarily around atomic and hydrogen weapons and the speed of jet aircraft for delivery to the enemy. Older and more traditional armaments of surface forces on land and sea are being curtailed as the air is exploited. Defense Secretary Charles E. Wilson has indicated that airpower will claim a larger percentage of the defense budget in the future.

In addition to this shift in emphasis on the character of U. S. military strength, the new strategic doctrine also changed its tempo. A long-range program has been set on maintaining and modernizing adequate military forces to meet the continuing crises of what President Eisenhower has termed "an age of peril." This is in contrast to the frantic mobilization of the Korean period to meet a "moment of crisis."

If properly implemented this change of tempo will bring the aircraft industry closer to its long-sought goal of a stabilized long-term procurement program as a substitute for the sharp peaks and deep valleys that have marked the past 20 years. It also will bring the taxpayers closer to their goal of obtaining adequate national airpower at a reasonable cost.

JOB FOR THE FUTURE

THE FUTURE OF AMERICAN AIRPOWER has been brightened considerably by the new strategic doctrine, but it still leaves many problems looming for both the aircraft manufacturers and the airlines. According to present plans, the manufacturing industry should stabilize in 1956 at a rate of about 5,000 new military planes annually plus a considerable maintenance and modification workload on military airpower already in being. The airlines will probably be given a real stake in operating many phases of the military airlift required by the new strategic doctrine.

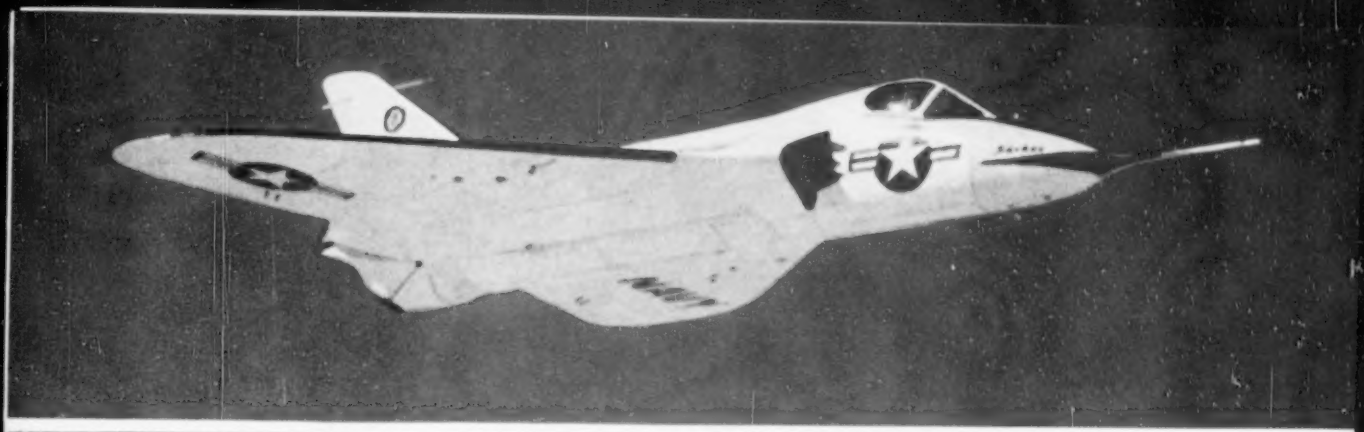
IF THE PROMISE of the new airpower doctrine is to be converted into the reality of a national airpower that is truly second to none, a concerted effort will be required by all segments of the aircraft industry and all government officials whose responsibilities concern aviation development. This effort should be aimed at hammering home to the public and their elected representatives in Congress the problems in achieving the quantity and quality of airpower that is necessary for survival.

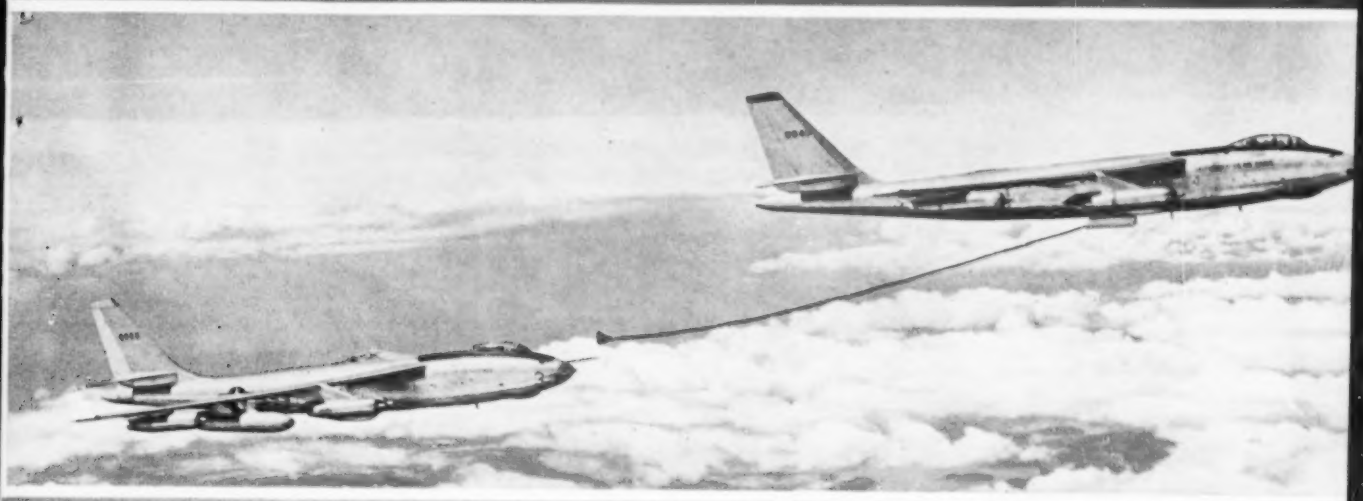
ROBERT HOTZ

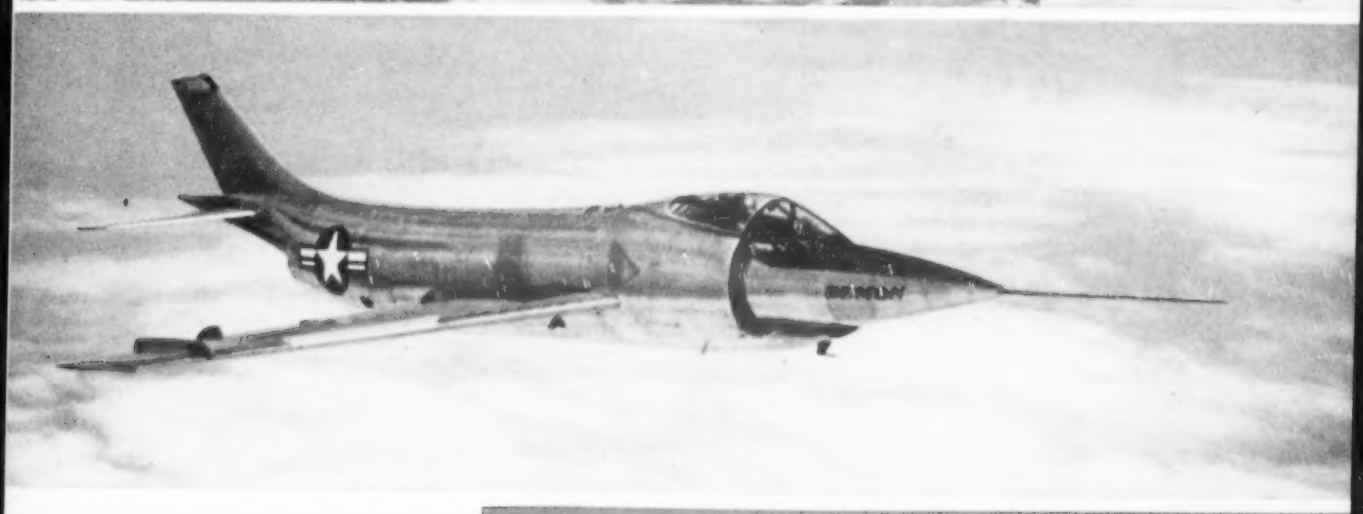
Color Portfolio Of New Military, Research Planes

BOEING YB-52
Stratofortress

REPUBLIC F-84F
Thunderstreak





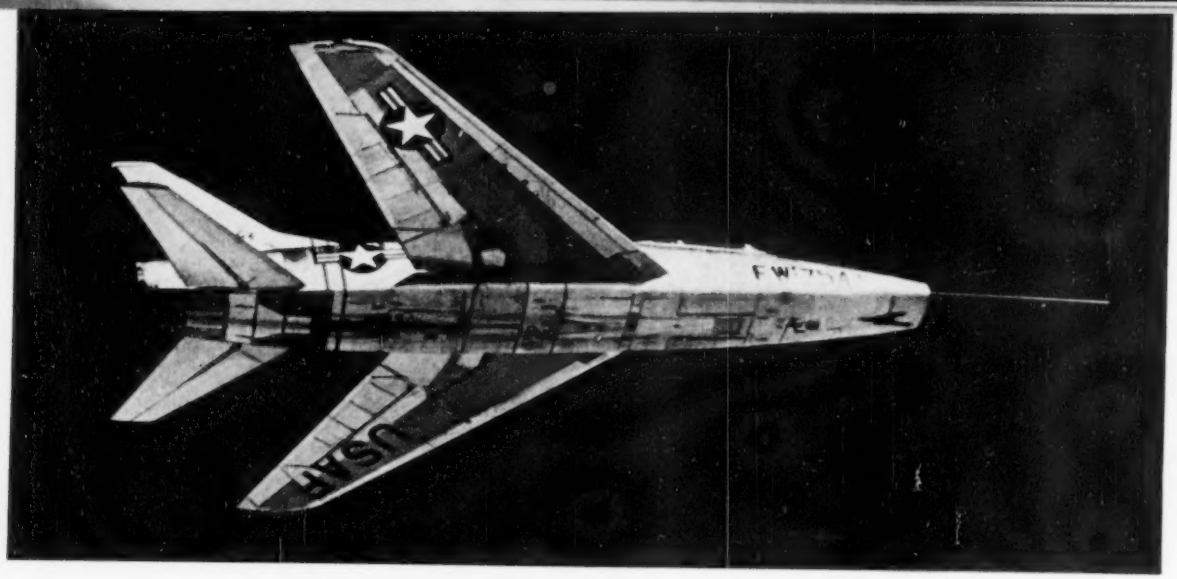


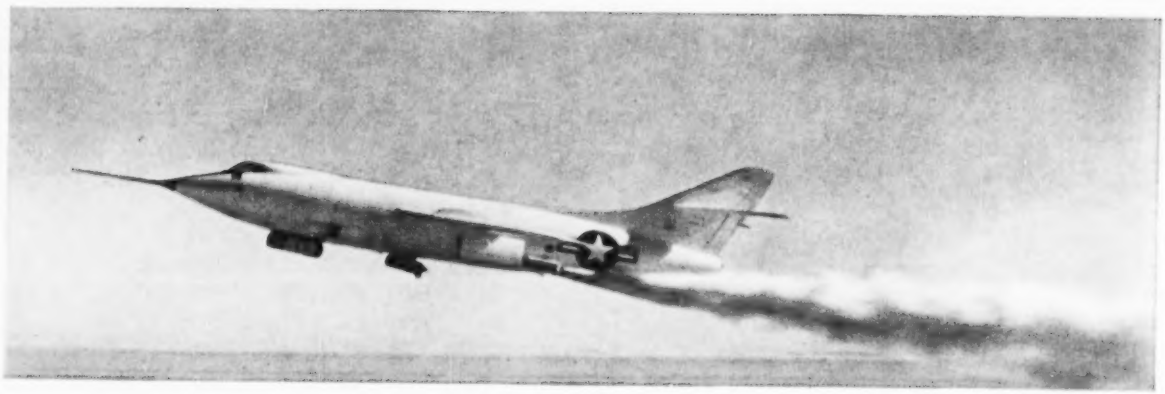
DOUGLAS F4D
Skyray

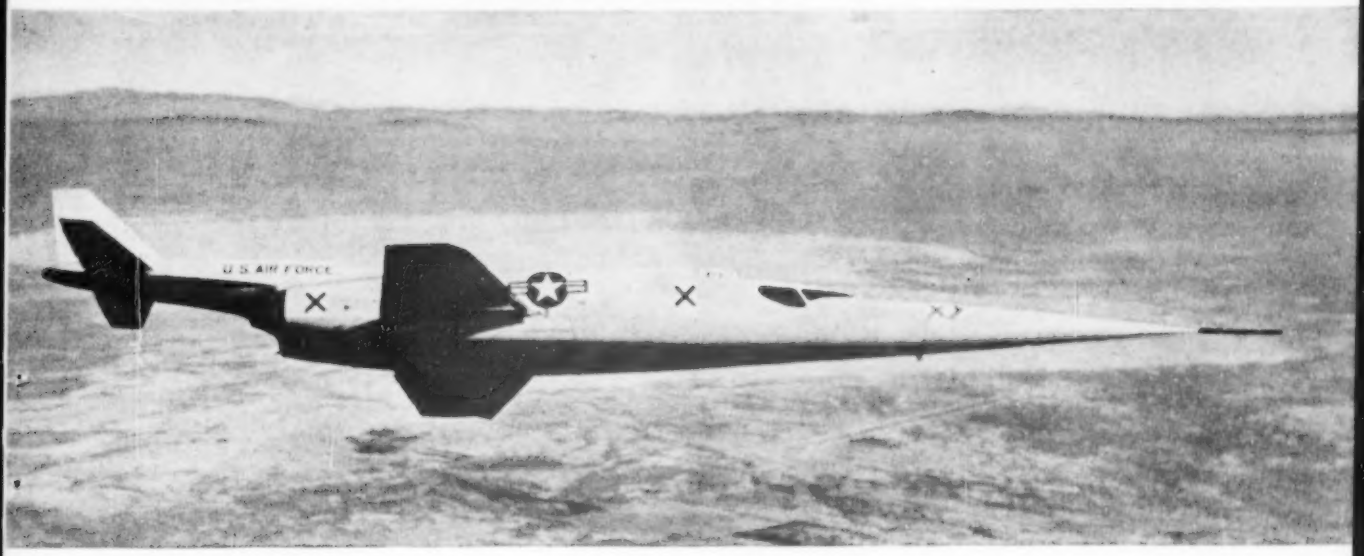
BOEING B-47
Stratojet

McDONNELL F3H
Demon

DOUGLAS A3D


USAF





■ left

NORTH AMERICAN F-100
Super Sabre

DOUGLAS D-558-II
Skyrocket

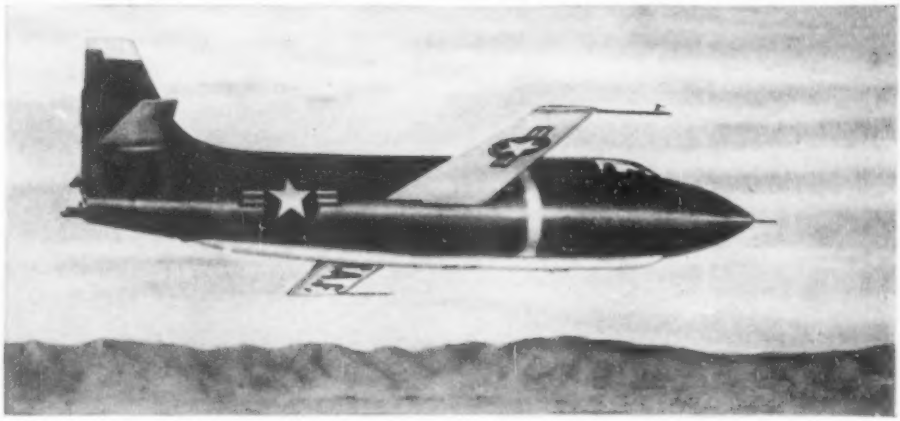
CHANCE VOUGHT REGULUS

■ right

DOUGLAS X-3

BELL X-1A

CONVAIR XF2Y
Sea Dart



"On the Way"
Regulus surface-to-surface guided missiles, now in production for the Navy at Chance Vought Aircraft, are designed to be launched from ships, submarines or shore bases.
NAVY

Chance Vought Aircraft INCORPORATED

DALLAS, TEXAS

STRIKING POWER of Strategic Air Command will be strengthened by addition of long-range, highspeed Boeing B-52 Stratofortress.

Air Force Takes Key Role in U.S. Policy

New doctrine recognizes the revolution in military methods stemming from development of atomic weapons and highspeed, long-range aircraft.

By Robert Hotz

The Air Force is rapidly becoming the dominant factor in United States military strategy. The new strategic doctrine of the Eisenhower administration, for the first time in American history fully recognizes the revolution in military methods wrought by the combination of atomic weapons with high-speed, long-range aircraft. As a result USAF now occupies a position as an instrument of national policy similar to that of the British Navy in the British Empire of the 19th century.

There is heartening evidence both within USAF, where a more mature type of leadership is growing fast, and externally among top Administration policy-makers and members of Congress that the full implications of this vital relationship between the quantity and quality of American airpower and the success of American policy is becoming more clearly understood.

The fiscal 1955 budget represented a definite break with the postwar "balanced forces" concept that divided the Defense Department budget in an even three-way split among the services. The fiscal 1955 budget allots USAF about 40% of the total Defense Department money.

Defense Secretary Charles E. Wilson has indicated that this percentage will increase in future military budgets. There are still some voices crying out from the Pentagon labyrinth for a return to the traditional and "more moral" methods of waging war but these outcries are diminishing both in volume and frequency.

► **The Road Back**—During 1954 USAF will be nearing the end of a long and frenzied effort to reach the quantitative and qualitative level of airpower necessary to cope with the requirements of the new national policy. For the first time since its demobilization after World War II, USAF will be close to a state of genuine combat readiness in relation to its potential opponents.

In 1949, the year before the Korean war began, USAF was a skeleton of 42 combat wings equipped mostly with World War II surplus aircraft that were obsolescent even then. By mid-summer this year, USAF will reach a strength of 115 combat wings. Total plane strength will have increased from 20,000 in 1949 to 22,000.

At the same time USAF was expanding to a 140% increase in its combat strength, it was also wrestling with the conversion from war surplus and early vintage jet equipment to modern transonic aircraft.

In place of the piston-powered F-51s and 500-mph. straight-wing F-80 jets of 1949, USAF fighter squadrons now have 700-mph. sweptwing Sabres and will soon get supersonic F-100 Super Sabres. The Air Force's all-weather capability has progressed from slow and ineffectual F-82 Twin Mustangs to stable of jet-powered, radar-equipped, and rocket-firing interceptors such as the F-89D Scorpion, the F-94C Starfire and the F-86D. Production is already beginning on the Convair F-102 supersonic delta wing all-weather interceptor.

Light bomber units that went to war in Korea equipped with piston-engine B-26 bombers will soon get B-57A twin-jet bombers equipped to carry atomic weapons. Strategic Air Command crews who fought MiG-15s in Korea with B-29s have traded their old Superfortresses for sweptwing B-47 multi-jet bombers.

USAF now has close to a million men in service; is training new pilots at a 7,800 annual rate; and is completing a chain of modern air bases stretching from the Arctic Circle to the African desert and literally girdling the globe.

▶**Equal to Mission**—During the next two years USAF will add 22 more combat wings to reach a level where its leaders feel it will be really capable of meeting its global commitments in the "age of peril."

With its expansion program operating at full throttle during 1953, USAF took a new look at its progress, problems and goals to revise them in terms of the new airpower doctrine.

The twin burdens of expansion and modernization accelerated by the Korean war produced management problems in USAF between 1950-53 that far surpassed anything in American industrial experience both in scope and complexity. It has been fashionable among some latecomers to the Pentagon scene to scoff at USAF management methods during this crisis when more than $50 billion was suddenly thrust upon an organization that was in the throes of an "economy" cutback. The combination of hindsight and the failure of the Third World War to materialize by 1954 give these gentlemen advantages not enjoyed by the men who had to struggle through the hectic period of 1950-53.

As the youngest of the military services USAF still suffers from a lack of sufficient capable leadership for its non-flying activities. However no service is making more strenuous efforts to develop management and technical career officers or emphasizes management concepts more throughout its activities than USAF.

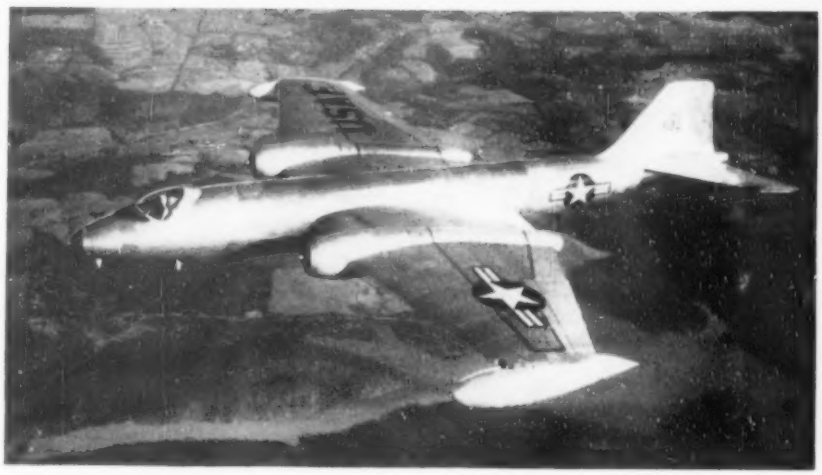
The full benefits from this program will not be evident for several years but it is obvious to Pentagon observers that USAF is moving in the right direction and at a lively pace. USAF has also exhibited a willingness to modify its command and organizational structures to meet the unique military problems arising from the swift developments in the atomic-aviation equation.

New Program

Most important result of the 1953-54 "new look" is the program for expanding USAF to reach a strength of 137 combat wings by 1957. This program differs only slightly in numbers from the 143-wing goal authorized just after the Korean war began. Six Troop Carrier wings are the actual difference. But there has been a significant recasting of USAF's combat composition in the new 137-wing program. Here is the difference in types of units authorized under each program:

	Old	New
Strategic Air Command	57	55
Air Defense Command	29	37
Tactical Air Command	40	34
Troop Carrier Command	17	11
Total	143	137

Basic reason for this change in USAF composition is the tremendous striking power offered by the new family of atomic weapons (AVIATION WEEK Aug. 17, p. 91) plus the growing threat of an intercontinental attack by the Russian air force equipped with atomic or thermo-nuclear weapons. The increase in Air Defense Command is aimed at meeting this threat particularly with the addition of five all-weather interceptor wings.



BOMBER FLEET making up USAF strength today includes Convair B-36 (shown left in FICON role with Republic F-84F), Boeing B-47 Stratojet (above as reconnaissance version RB-47E) and Martin B-57A for low-level intruder missions.

▶ **Potent Weapons**—The decrease in Tactical Air Command wings is possible because the new programmed strength of 34 wings equipped with the Republic F-84, Martin B-57A and Douglas B-66—all capable of carrying small-size atomic bombs that pack the same destructive power as the weapon that devastated Nagasaki in World War II—has much greater striking power than the 40 wings previously programmed with conventional types of weapons.

The new program raises a question as to what good is achieved by reducing Strategic Air Command by two wings. Many observers believe that this trend should be reversed and an increase for SAC is in order. Most vulnerable point in the new program is the elimination of six Troop Carrier wings at the same time the new strategic policy calls for increased air mobility for the army to compensate for its manpower cuts.

▶ **Airlift Needed**—To many Pentagon observers these two phases of the new strategic doctrine do not match. If the Army is to do its job successfully with fewer men it must have more airlift to enable the swift shifting of its strategic reserves to global trouble spots.

Other angles of the "new look" include:

- Moratorium on new base construction.
- Shift in procurement emphasis from mass production of current types to getting newer and improved types into production.
- Shift from a policy of obligating procurement money as fast as possible by letters of intent to hard bargaining on firm contracts.
- Major reductions in spares and spare parts procurement.
- Further stretchout of aircraft production.

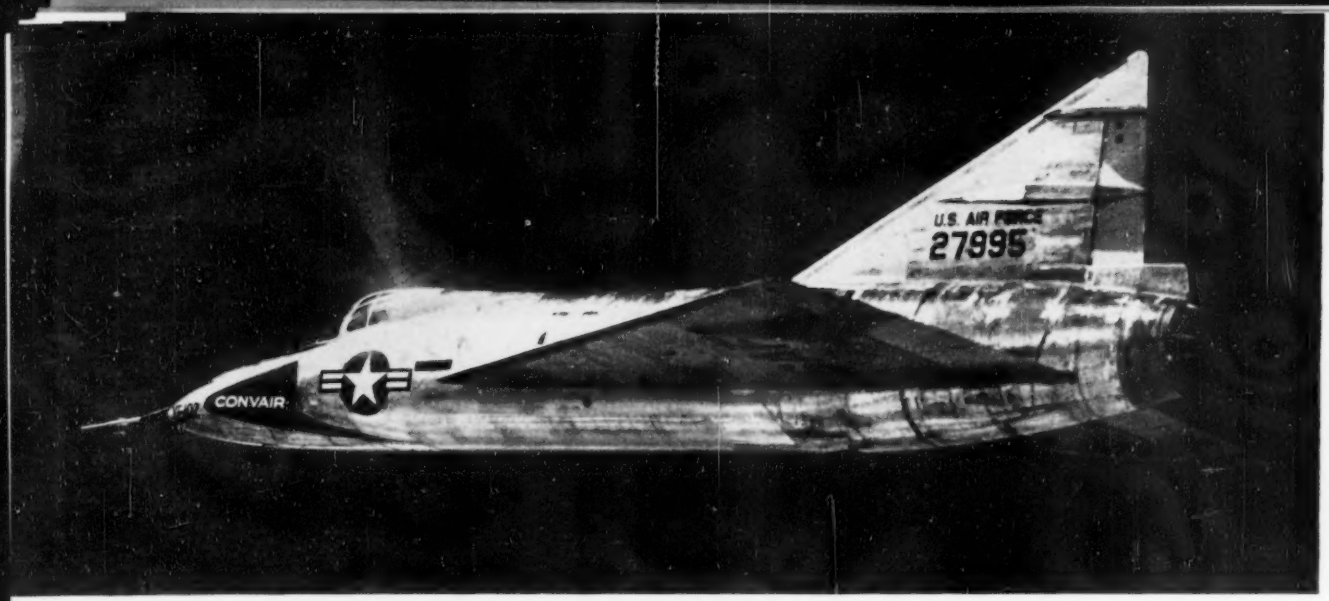
Construction Problem

The moratorium on new base construction is expected to be lifted in fiscal 1955 with a billion-dollar public works bill. However, even the USAF secretariat, who are the most enthusiastic about the "new look" economies, admit that considerable valuable time was lost in the USAF construction program by this moratorium. They anticipate regaining this lost time during 1954-55, but this goal appears too unrealistic.

USAF has a critical need for new construction not only for its global air base network for tactical and support units but also for its basic research, development and testing facilities. The postwar technical revolution in aviation made most of its wartime bases and research facilities obsolete and military budgets have not provided enough new construction to meet this critical need. The runways that sufficed for B-17s and Mustangs will not handle B-36s, B-47s or F-86s nor does the distribution of World War II bases meet anything but the modern training requirements for USAF.

Most of the air bases built during World War II were scattered throughout the South and Southwest. The bases required now for air defense of North America and mounting intercontinental atomic air attack must be located in the northern extremities of the continent and its approaches. Base construction of the types required for modern jet aircraft and in the locations required by modern global strategy is a critical USAF need.

▶ **Research Construction**—Similarly the windtunnels that served well for subsonic research are hopelessly obsolete



TOMORROW'S INTERCEPTOR is typified by the supersonic delta-wing Convair F-102 armed with air-to-air missiles. . . .

for the supersonic problems now confronting USAF. Modern test facilities, particularly for missiles, dwarf previous concepts of this function and require expensive construction.

The cost of the research and development testing facilities required for the era of supersonic flight and guided missiles is so high that no private contractors could afford to build or operate them without assistance from the government.

As the largest user of aeronautical research and hardware it is clearly USAF's responsibility to spearhead a program to provide these facilities which are vital if this country is not to falter in maintaining technical superiority in the air.

Procurement Shift

By next July USAF will have taken delivery on about 24,000 modern aircraft produced since the beginning of the Korean War in mid-1950. This sizeable increment of modern aircraft has alleviated the pressure of obsolescence on USAF, so heavy four years ago that units went into combat in Korea equipped with World War II vintage aircraft because there was nothing else available.

With the pressure for sheer quantity somewhat eased, USAF can afford to take a harder look at the qualitative aspects of its equipment. During 1953 there was a thorough screening of the USAF aircraft procurement program with a view toward eliminating future production of types that already were approaching obsolescence; types that would offer only marginal performance improvements over existing types; and types that appeared to be excessively costly to mass-produce.

Funds recovered from cancelation of production contracts or removal of aircraft from future programming were used to spur production of new planes that offered considerable performance improvement and had already performed sufficiently in the air to indicate they were technically sound.

► **Emphasis on Quality**—For the future, USAF procurement emphasis definitely will be on quality of equipment rather than on sheer quantity or availability. There is also a definite USAF trend to reach for large qualitative improvements through the weapons systems development concept rather than nibbling at minor improvements through the model improvement philosophy.

One of the major clues to the size of future USAF procurement programs will be the variety of technically sound hardware offered by the aircraft industry.

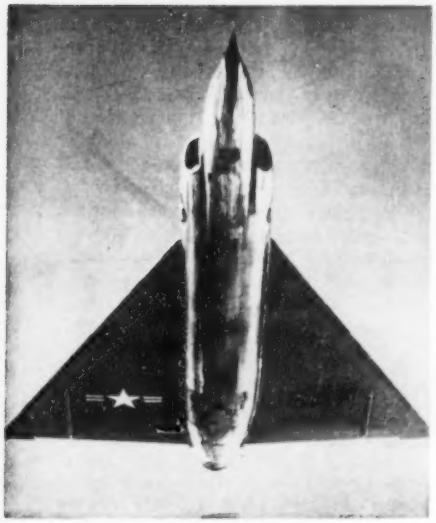
The rate at which Air Force will require modernization of its aircraft inventory—another major factor in future procurement—will depend also on the rate of technical progress achieved by the aircraft industry. A good example of this may occur in the requirement for tactical aircraft where present plans for future production could be completely upset by the appearance of a technically sound vertical take-off fighter.

Contract Changes

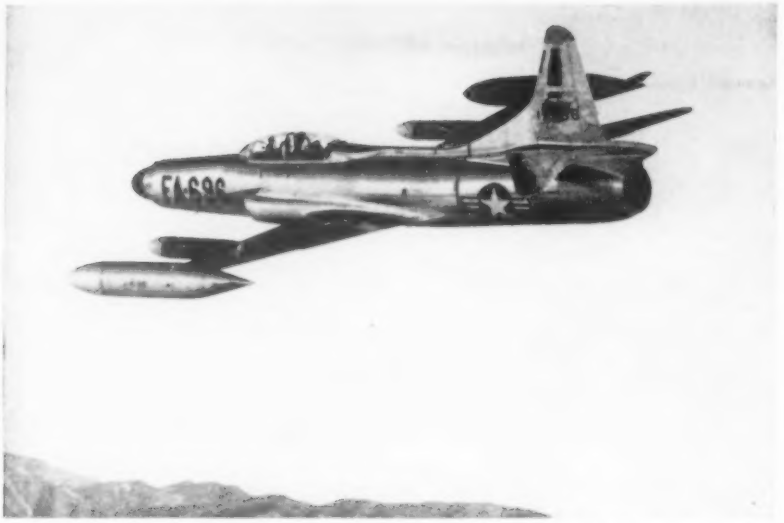
In its haste to obligate the billions in procurement funds suddenly dumped in its lap after Korea, USAF used letters of intent freely. As a result an enormous backlog of contracting negotiations accumulated. Only last year did this mountain of unconverted letters of intent begin to diminish significantly. In some cases the actual production work specified in a letter of intent was completed and delivered to USAF before a firm contract was actually negotiated. This was poor procedure for both the contractor and USAF. Policy now is to delay actual obligation of new procurement funds until a firm contract is negotiated and use letters of intent only for emergencies such as modification programs or starting portions of an extremely long lead time program.

The USAF production program has been through several "stretchouts" since it was organized in the fall of 1950 when the impact of the Korean war had generated a frenzy equal to the production expansions of World War II. These earlier stretchouts were caused first by unrealistic production schedules that called for output far in excess of anything that industry could actually do even if given top priority on tools, materials and manpower. Their secondary cause was the unwillingness of the government to establish any effective priorities for the defense industries, including aircraft, on any of these three vital ingredients for accelerated production.

► **New Stretchout**—The stretchout quietly effected by USAF during 1953 was not based on the aircraft industry's inability to meet military production schedules. Its main purpose was to revise the production program realistically to alleviate the peak and valley that was looming for the industry in 1954-55. Industry could have easily reached the original production peak scheduled for 1954. But if this schedule had prevailed the industry would have gone from this peak onto



Until the F-102 is in service . . .



TODAY'S INTERCEPTORS will be the rocket-armed Lockheed F-94C . . .

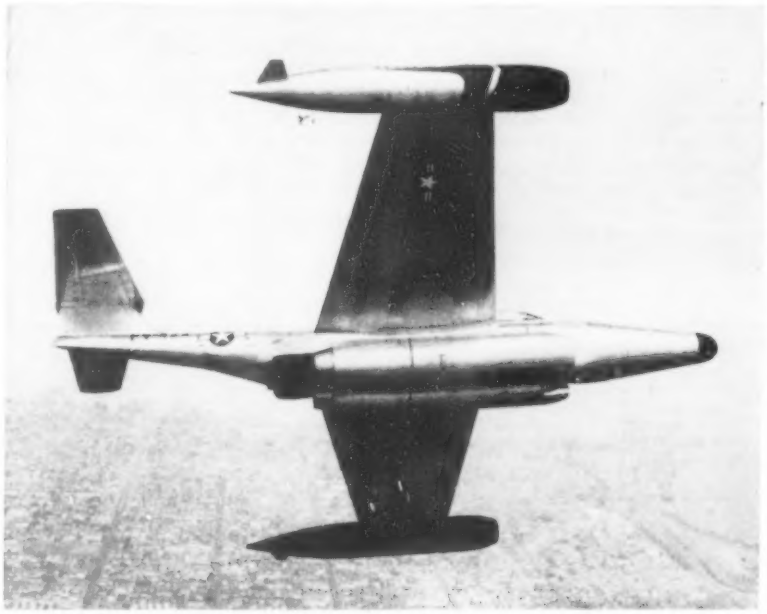
a toboggan slide downward into 1955 and 1956 that would have meant closing some plants, loss of large quantities of production workers and a financial dislocation almost as bad as the 1946-48 period.

Now the production peak has been scraped off into a plateau extending through 1955 and the downgrade reduced to a more gentle slope reaching into 1956.

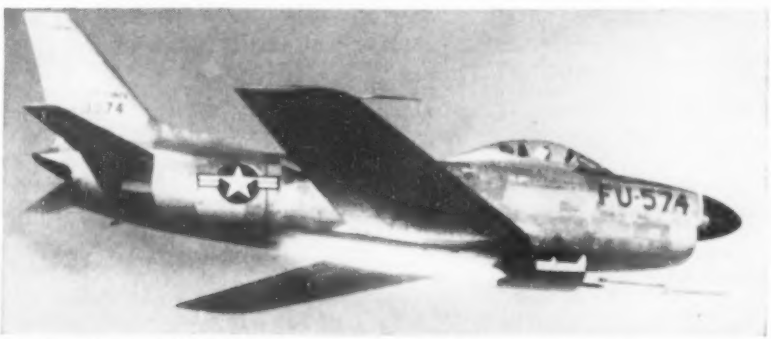
The 1953 stretchout was individually tailored to meet each company's specific needs and should do much to restore an element of stability to the aircraft production future.

When USAF began its post-Korean expansion program there was little operational experience available on which to base future requirements for spares and spare parts provision for jet aircraft. Since the jet engine was still in its early infancy operationally when the production expansion programs were organized, USAF planners allowed generous margins to meet future spares requirements. Operational experience of the past three years, particularly in Korean combat, combined with a rapid rate of technical progress, now make it possible to revise spares requirements on the basis of more factual data. During 1953 USAF was able to save close to a billion dollars by reducing its spares requirements and future savings will be even more substantial. There are still large areas ripe for further economy in the spares provision, depot operations and maintenance procedures and USAF is continuing to probe along these lines.

► **Fortunate Combination**—There have been many attempts to assign credit for the "new look" taken during 1953 to a specific source but Pentagon ob-



NORTHROP F-89 Scorpions with podded, wingtip rocket armament and . . .



NORTH AMERICAN F-86D with retractable rocket armament tray.

Major USAF Commands

Air Defense Command
Ent AFB, Colorado

Air Materiel Command
Wright-Patterson AFB, Ohio

Air Proving Ground Command
Eglin AFB, Florida

Air University
Maxwell AFB, Alabama

Air Training Command
Scott AFB, Illinois

Air Research and Development Command
Baltimore, Md.

Headquarters Command
Bolling AFB, Washington, D. C.

Continental Air Command
Mitchel AFB, New York

Strategic Air Command
Offutt AFB, Nebraska

Tactical Air Command
Langley AFB, Virginia

Military Air Transport Service
Andrews AFB, Md.

Alaskan Air Command
Elmendorf AFB

Caribbean Air Command
Albrook AFB, C. Z.

Far East Air Force
Tokyo

Northeast Air Command
Pepperrell AFB, N. F.

USAF Europe
Wiesbaden, Germany

USAF Security Service
Brooks AFB, Texas

USAF Planes on Hand

As of Jan. in the year below	Type				Totals
	Combat	Transport	Trainer	Communications	
1942	4,477	254	7,340	226	12,297
1943	11,607	1,857	17,044	2,796	33,304
1944	27,448	6,466	26,051	4,267	64,232
1945	41,961	10,456	17,060	3,249	72,726
1946	26,077	7,500	7,611	3,588	44,782
1947	17,186	4,538	6,297	2,014	30,035
1948	13,118	3,536	5,714	1,446	23,814
1949	9,031	3,712	6,177	1,148	20,068
1950	8,004	2,839	5,811	568	17,222
1951	8,159	2,859	5,961	358	17,337
1952	.....	.....	.....	.....	20,000*
1953	.....	.....	.....	.....	20,500**
1954	.....	.....	.....	.....	22,300***

* Includes 16,000 in active inventory and 4,000 inactive.
** Includes 16,500 active and 4,000 inactive.
*** Includes 17,700 active and 4,600 inactive.
SOURCE: USAF.

USAF Aircraft Types on Order

Company	Plane	Name	Company	Plane	Name
Beech	T-34	Mentor	Martin	B-57	Night Intruder
Boeing	B-52	Stratofortress	McDonnell	F-101	Voodoo
	B-47	Stratojet			
	KC-97	Stratofreighter	North American	F-86F	Sabre
Convair	B-36J			F-86D	Sabre
	F-102			F-86H	Sabre
	T-29			F-100	Super-Sabre
				T-28	
DeHavilland	L-20	Beaver	Northrop	F-89D	Scorpion
Douglas	C-118		Piasecki	H-21	Work Horse
	C-124	Globemaster 2			
	RB-66		Republic	F-84F	Thunderstreak
				RF-84F	Thunderstreak
Fairchild	C-119	Packet			
	C-123	Avitruc	Sikorsky	H-19	
Lockheed	RC-121C	Constellation			
	T-33				
	C-130				
	F-94C	Starfire	SOURCE: USAF.		

servers who have followed the development of USAF since its creation in 1947 are inclined to assay it as a combination of the pressure of technical developments in both aircraft and atomic weapons, the emergence of USAF top leadership from the maze of the post-Korean crisis and the fresh stimulus of a new civilian secretariat. With a good many of its management problems rapidly untangling during 1953, USAF entered 1954 in better shape to deal with its military missions.

Strategic Air Command

With the end of actual fighting in Korea, the Strategic Air Command has regained its top priority on the USAF mission list.

"Our most outstanding and as yet unchallenged superiority in air weapons is our ability to deliver them at long range," said General Nathan F. Twining, USAF Chief of Staff. "It is necessary that we maintain and increase this advantage for several reasons.

"First, the most critical targets in the Soviet Union are far beyond the Iron Curtain, some 1,300 mi. or more from any accessible position on land or sea. Only long-range bombers can traverse this distance if it ever became necessary to strike at Soviet aircraft factories, weapons centers, supply centers and sources of military power.

► **Fighter Force**—"The huge Soviet air force, despite its 1,000 long-range bombers, is 95% short-range fighters and bombers. We must be able to strike our heaviest blows from bases outside the range of these thousands of short-range aircraft.

"They outnumber us heavily both in Europe and the Far East.

"Only very-long-range aircraft can reach vital Russian targets from this hemisphere and from other areas more distant from the Iron Curtain than Europe and Japan. While we hope to hold many forward bases, we must be able to strike effectively from our home bases and from intermediate bases that we can always use.

"Long-range bombers can operate more effectively in bad weather and in darkness than can smaller planes with less equipment. They can navigate more dependably and can spot targets more effectively under conditions more favorable for attack. It has been proved again and again that these bombers can bomb just as accurately under combat conditions as can smaller planes operating at lower altitudes.

► **Variety of Routes**—"Long-range bombers can operate over a variety of routes of approach and withdrawal and at a wider variety of altitudes, thus greatly complicating the task of enemy defensive systems. They can carry more electronic equipment to detect enemy

FOUR SABRES streak off runway clawing for altitude. Immortalized by Korean air war, the F-86 is mainstay of USAF fighter strength.

countermeasures and to jam and confuse enemy radar.

"The big planes can carry heavier loads of any type weapon. They can carry all types of bombs including the newest types. Because of fewer limitations on size and shape, the bombs they carry are far more efficient than smaller bombs. The smaller bombs are sometimes called 'tactical' bombs, but they are actually less suitable for use against many tactical targets. Larger bombs cover more territory. They are more efficient and effective in normal tactical situations that involve troops and equipment dispersed over wider areas.

"Long-range bombers can be operated as a global force tied to no theater of operations and shifted from one continent to another as the need arises or as the situation demands. They can be concentrated quickly to meet a threat or to exploit an opportunity. They can go into action at a distance far more rapidly than any other type force and they can withdraw just as rapidly.

"In the Korean war Lieut. Gen. Emmett O'Donnell was operating a wing of B-29s from a base on the far side of the world just five days after departing from the United States.

"Recently B-47 squadrons have moved from bases in the United States to Europe and Africa in less than a day. B-36s can make round trips of that length without landing.

"During World War II, B-29s operating out of Guam took 15 hr. for their missions to Tokyo. As an indication of how rapidly airpower has advanced since World War II, the B-52 can make two roundtrips between Guam and Tokyo in much less time than it took the B-29s to make just one mission.

"Wars have been won or lost and tactics and strategy have been extensively modified because of a 20 to 30% increase in weapons capabilities. Here we have a 100% increase in long-range air capability in just ten years time accompanied by a thousand-fold increase in the power of weapons delivered by air.

"There is no longer any question that our total long-range airpower is a global force that must be centrally operated and controlled. It can now be maneuvered over the Northern Hemisphere more rapidly than the armies of the past could maneuver over a single battlefield."

Mobility Formula

During the last nine months, SAC has combined the 600-mph. speed of the multi-jet B-47 bomber with the virtually unlimited range provided by aerial refueling. The process of converting SAC's medium bomber from B-29 and B-50 equipment to the B-47 is in full swing. Aerial refueling by KC-97 tanker squadrons has become so routine that thousands of operational hookups are made between SAC bombers and tankers every month.

The third element in this formula for unprecedented military mobility is the logistic support furnished by C-124 and C-97 transport squadrons—both from SAC's own transport organization and from Military Air Transport Service. These giant transports with intercontinental range can furnish spare engines, aircraft parts, bombs, avionic equipment and ground maintenance crews at a 300-mph. pace that far outstrips any other method of transport.

► **4,800-Mi. Jump**—This new method of SAC mobility has developed to a point where entire combat wings of B-47 bombers are making the 4,800-mi. jump from permanent bases in Louisiana and Florida to the great complex of Moroccan staging bases in an average of 10 hours.

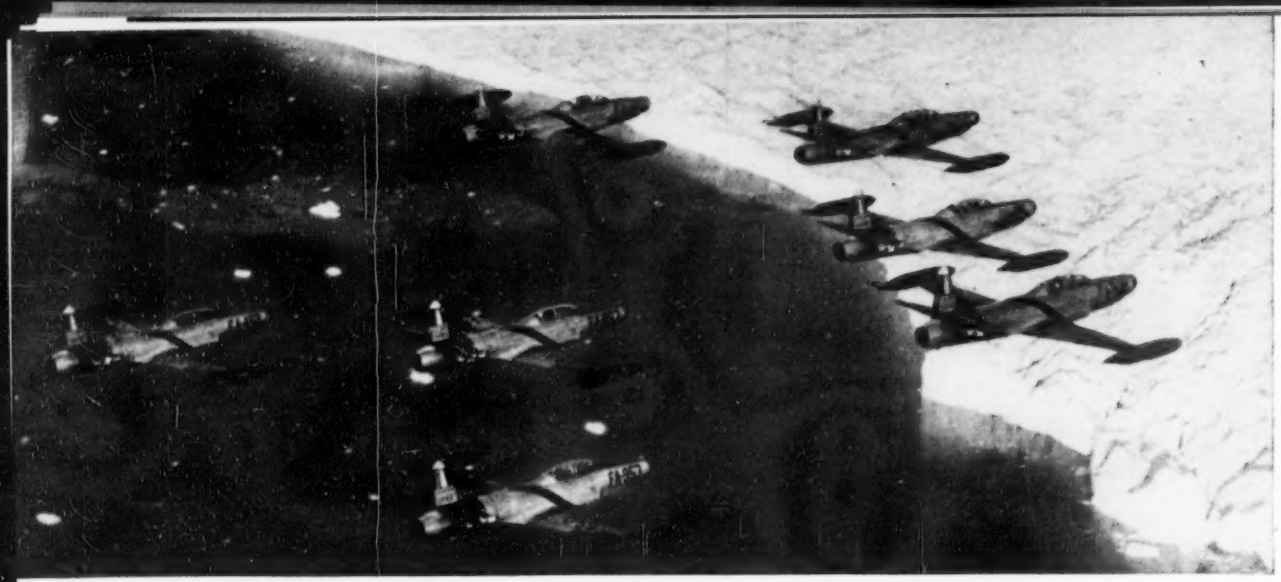
Within 24 hours after arrival at the North African bases, these B-47 squadrons fly a 4,000-mi. simulated combat mission deep into the heart of Europe. The B-47 squadrons are accompanied by their supply train of tankers and transports, enabling them to carry on a sustained combat effort from the advance bases for 30 days or longer.

The SAC permanent bases in Florida, Louisiana, Texas and Arizona lie well beyond the range of the Tupolev 200, the longest-ranging bomber yet flown by the Russians. However, the North African bases are within B-47 range of the Russian oil fields in the Caucasus, the factories of the Ukraine and many other vital targets.

► **Fighter Role**—The combination of aerial refueling with small atomic bombs has also created a strategic role for fighter aircraft. SAC now has a number of strategic fighter wings equipped with Republic F-84G jet fighters modified to carry small atomic bombs. This same type fighter also has made nonstop crossings of the North and South Atlantic utilizing aerial refueling, and a complete F-84G fighter wing was moved from the Pacific Coast to Japan with servicing by flying tankers.

SAC is getting F-84F sweptwing fighters as replacements for the straight-wing G models, but its principle hope for future development of the strategic fighter role rests on the McDonnell F-101 Voodoo. The F-101 is closer to an old-style medium bomber with a gross weight of about 30,000 lb. and an extraordinarily long range for a jet fighter. It also will have atomic capabilities.

► **Interim System**—Development of the FICON system for carrying a parasite F-84F under the B-36 has opened another strategic application for the atomic-bomb-carrying fighter. Once the basic technical hurdles have been surmounted in making the FICON operation routine, SAC undoubtedly will develop it as an interim measure to bridge



DEFENSE FORMATION of Lockheed F-94Bs from 318th Fighter-Interceptor Squadron at Thule, Greenland, roars over polar icecap.

the technical gap until successful air-to-ground missiles are operational.

The atom-bomb-carrying fighter can ride underneath the B-36 during most of an intercontinental trip and then cut loose just outside the range of the Russian target defense interceptors for a supersonic penetration of the target.

If the fighter can locate the B-36 mother ship, it can hook on in flight for the return trip. If not, the trade of an atomic bomb successfully delivered on target for a fighter aircraft and pilot is good military business.

► **Radar Picket Line**—FICON also will probably be used for long-range reconnaissance penetrations of enemy territory and as an early-warning device.

This latter application would see the B-36 mother ship well equipped with airborne search radar and functioning as a picket plane along the perimeter of enemy territory.

When unidentified aircraft are located on the B-36 radar, the parasite fighter can be cut loose for swift investigation. If the target is identified as an enemy, the parasite can cut loose with a lethal blast of rockets or an air-to-air missile such as the Falcon to make the kill.

► **H-Bomb Carrier**—Although the B-47 rapidly is taking over as the standard SAC medium bomber, the venerable B-36 is still its only heavy bomber. The B-36 fleet is likely to remain in active service for a good many more years with duty as a radar picket plane, airborne aircraft carrier for FICON fighters and possibly as an aerial tanker for jet bombers.

For the immediate future, the B-36 fleet probably will be the only carrier capable of handling the hydrogen bombs. First thermo-nuclear test device exploded at Bikini was about the size of a GCA trailer and usable weapons are not expected to be much smaller for some time. Hence it appears the B-36 is the only SAC bomber that will have sufficient bomb-bay cubage for hydrogen weapons in the immediate future.

It is expected that the B-52 Stratofortress will be engineered to carry hydrogen bombs, but it will not be in any appreciable SAC service before 1957.

► **Target Penetration**—SAC's basic approach to its problem of target penetration appears to involve the extremes of altitude—as high as possible to get above the effective areas of radar detection and as low as possible to approach underneath the lowest angles of radar coverage.

Current SAC bombers, such as the B-47 and B-36 as well as future developments such as the B-52 and B-58 supersonic Hustler, are aimed at high-altitude penetration. But also under development are several versions of an extremely low-level strategic bomber aimed at making penetrations below the scope of radar detection.

► **Supersonic Bomber**—For at least another five years, SAC will be dependent on subsonic bombers with a possibility that final target penetrations can be made by either FICON fighters or air-to-ground guided missiles such as the Bell B-63 Rascal in the final phase of this period. After that, development is pointing toward the supersonic bomber, of which the Convair B-58 Hustler is the principal project now in the mill.

After the supersonic bomber, the strategic role probably will fall to the intercontinental ballistic missile. There is some responsible opinion in military circles that too much development effort is being devoted to long-range aircraft development and not enough to bringing the long-range ballistic missile into the realm of a practical weapon.

USAF is sponsoring development of the Convair Atlas as a long-range ballistic missile and the North American Navaho as a cruising type of long-range missile.

Active Plane Inventory

	FY 1954	FY 1955
USAF	21,000*	22,900*
Navy	13,130**	12,900**
Total	34,130	35,800

* Includes 16,000 assigned to units.
**Includes 9,941 assigned to units.

Air Defense

Building an effective air defense system is a relatively new task for USAF. Except for the early phase of its participation in World War II, USAF was engaged primarily in offensive action—putting the burden of air defense on the enemy.

Neither the Germans nor the Japanese ever developed a strategic air offensive power. Now there is ample evidence to show that the Russians are making a determined effort to build a long-range strategic bombing force capable of delivering their atomic and hydrogen weapons over intercontinental ranges.

USAF now is faced with the problem of constructing an air defense system that will blunt and parry any possible thrusts of the Russian strategic air force against North American targets.

► **Technical Burden**—The present trend in aircraft favors the offense and places an extraordinary technical burden on the defense. Since World War II, the

cubage of air space available to the offense has doubled with the rise in bomber altitudes from 25,000 to 50,000 ft.

Bomber speed has increased from not much more than 200 mph. to 650-700 mph. and forced defensive fighters into the maneuverability restrictions of the transonic speed range.

► **Increased Defense**—Not much more than a year ago Gen. Hoyt Vandenberg, then USAF Chief of Staff, estimated the continental air defense system would not be able to destroy more than 30% of an attacking bomber force before they reached their targets—even after the defensive system had been bolstered to its maximum capability and effectiveness.

Much more USAF effort now is going into air defense problems than when the general spoke, but there still is no cause for optimism in this endeavor. SAC bombers successfully practice bombing key American cities almost every night in the week, despite the best efforts of the air defense system to locate and intercept them. Even the venerable B-36 is an elusive target for the interceptors now available to USAF and Navy fighter squadrons.

Principal problems in building an effective continental air defense system are:

• **Warning.** Early-warning radar network still is sketchy and can be easily penetrated. Ground radar stations in the Arctic are extremely vulnerable to enemy air attack. Radar picket aircraft are not yet ready for routine operations along the Arctic and ocean approaches to North America.

U.S. and Canada still have not ironed out national differences over the type and location of early-warning radar facilities. Major USAF effort is being devoted to solving technical problems of providing a semi-automatic type of ground environment for an air defense system that will gather, correlate and transmit data on an attacking force directly to airborne interceptors with only monitors on the ground to check the systems operations.

• **Interception.** Most USAF interceptors now in service do not have either the range or speed to intercept attacking bombers at sufficient distance from the target to make effective attacks before bombs are dropped. Range also is a basic weakness of the anti-aircraft missiles nearing operational use. This range limitation of the Army's Nike anti-aircraft missile has raised the question of whether the installation of Nike battalions supposedly to defend U.S. cities against bomber attacks is little more than extremely expensive Army propaganda.

The F-86D and F-94C have extremely limited range and operational time at the altitudes where they must attack enemy bombers. The F-89D has longer range, but there is a growing feeling in some USAF circles that what really is needed is an aircraft type that could function in the air much as a Navy destroyer does at sea. This type aircraft would be equipped with long-range airborne radar to locate enemy bombers, sufficient range to meet them a long way from their target and enough armament to conduct a running battle with them in the manner that submarine wolf-packs harassed convoys at sea.

► **Weak Fighters**—USAF still is building large numbers of day fighters in proportion to its production of all-weather interceptors. This trend continues despite development of all-weather interceptors with performance equal to or better than their day fighter contemporaries. Navy virtually has abandoned its day fighter category for future fighters and is equipping all its new, highspeed fighters with all-weather capabilities.

Another weakness in U.S. defensive has been their traditional design for offensive rather than defensive capabilities. In contrast, the design of the Russian MiG-15 emphasized its defensive role as a high-altitude interceptor featuring fast rate of climb, heavy armament and high-altitude performance at the expense of its characteristics as an offensive fighter bomber.

► **Defense vs. Politics**—Air defense of the North American continent also has become entwined with domestic politics and considerable pressure is being exterted on USAF, particularly from the more vulnerable population centers of the Northeast and Northwest, to devote a larger share of its effort to defensive efforts.

USAF policy has not veered from primary emphasis on its long-range retaliatory bombers as the best insurance against enemy air attacks, but it shows signs of bending slightly in the face of the political pressure for an umbrella of air defense.

Military men are aware, as the politicians are not, that an air defense system never can be built that will provide an invulnerable protective umbrella over American cities. Any determined enemy air attack with atomic weapons will cause tremendous destruction despite the best defensive efforts. All an air defense system can hope to do is to boost the cost of air attacks so high that an enemy will hesitate to pay it or, if he does, extract such a heavy attrition on his attacking forces, that he will lack the resources to sustain the attacks.

► **Tactical Future**—The future of tacti-

AVIONIC EYES of airborne radar in F-86D team with ground set in U. S. defense.

cal aviation is keyed to three technical developments:

- **Small atomic bombs.**
- **Increasing all-weather capability.**
- **Vertical-takeoff aircraft.**

Development of small atomic bombs has given the fighter-bomber and light bomber a striking power undreamed of only a few years ago. They become an extremely potent weapon against ground forces that are forced to mass for offensive action. The Korean war proved that tactical airpower desperately needs a vastly improved capability for darkness and bad weather to clamp a firm stranglehold on enemy ground forces.

Vertical-takeoff fighters now under development will free tactical airpower from the immobility of the 10,000-ft. hard surfaced runways required by most fully loaded jet fighter-bombers.

Airlift Problems

Military airlift is a critical problem for both USAF and the Army. Combat operations of USAF require the speed of an aerial logistics system to take full advantage of the unique characteristics of air war. The 650-mph. speed of SAC jet bombers cannot wait on the 90-day snail's pace of the conventional supply pipeline of surface transport.

The Army requires adequate airlift to fulfill its role as a fire department to extinguish minor aggressions wherever they occur. It cannot respond to international fire alarms on a global scale if it is keyed to surface transport. Nor can it meet these far-flung requirements with fewer men unless it gets the mobility afforded by air transport.

Military air transport resources now are scattered among:

- **Military Air Transport Service.**
- **Troop Carrier Command.**
- **Strategic Air Command.**

Most military planners agree the airlift requirements cannot be met by continuing the present dispersal of air transport equipment. How to reorganize these resources to meet the twin needs of Army's mobility and USAF aerial logistics system is one of the really knotty problems being debated in the Pentagon. The air staff of USAF has been wrangling with this problem for more than a year and there are indications that if a solution is not proposed soon by USAF, the Army will take steps to develop its own long-range airlift.

▶**Transport Family**—USAF and the Army are agreed on a technical development program calling for production of a family of transports ranging from the Chase-Fairchild C-123 Avitruc as the smallest members through the Lockheed C-130 in the medium class and the Douglas C-124 and C-133 types as the heavy transports.

This family is aimed at meeting the requirements for military airlift from the shorthaul assault transport assignment to long-range intercontinental operations.

All of these transports will have cargo compartments designed to standard military equipment dimensions and standard loading heights.

USAF already has conducted successful experiments in aerial logistics for movement of jet engines under the pressure of the Korean war, but it is moving extremely slow in making wider applications of this experience.

▶**Combat Cargo**—One possibility for the reorganization of military airlift is the creation of a combat cargo command along the lines successfully pioneered during the Korean war by Lt. Gen. William Tunner and Brig. Gen. John P. Henebry.

Basic concept of this type airlift is concentration of all air transport resources under a single command and trained to perform any type of airlift mission, including delivery of assault troops to combat zones, air drop of supplies to combat units, air evacuation of sick and wounded and long-range airlift of supplies and reinforcements. The airlift available from this type organization is assigned on a priority basis to the most critical need at the time as determined by the military high command.

If the Tunner-type combat cargo command were used as the new airlift pattern, it is likely that MATS would be stripped of its cargo planes and would function primarily as a military courier service and operator of air bases and facilities that did not fit into requirements of other command but were necessary in the national interest.

There is another possibility that, in the organization of an aerial logistics system, the commercial airlines will be given primary responsibility for operating the military cargo services required within the North American continent, leaving the purely military airlift available for long-range foreign operations.

Weapons Systems

The future of USAF and the country depend on the continued maintenance of technical superiority in the air. With tremendous increase in the destructive power of airborne weapons, the emphasis has shifted from sheer quantity to superior quality.

During the past 18 months, USAF has shown an increasing sensitivity to the critical need of improving its qualitative position. It is placing more emphasis on the development of complete weapons systems instead of individual items of hardware jiggered into an airframe envelope and is taking a more active role in extending the scientific frontiers of field pertinent to the growing technical requirements of the atomic-airpower capability.

Spearhead of this development is a new realignment of the authority and responsibilities of the Air Research and Development Command and the Air Materiel Command, aimed at a more realistic role for the quality factor in USAF aircraft and equipment development. The development of the single prime contractor policy was another attempt to supplement the limited management and technical skills available within USAF with this type of talent available in industrial firms.

USAF also is in the midst of a program aimed at constructing the type of development and testing facilities required by its industrial contractors for their new products.

MATS OPERATIONS

	Passenger-Miles	Patient-Miles	Total Ton-Miles
June 1-Dec. 31, 1948	280,386,061	24,253,934	78,174,067
1949	438,893,176	39,149,352	128,529,796
1950	532,903,605	170,416,149	173,559,413
1951	666,891,763	221,747,514	263,727,904
1952	950,853,198	149,015,307	285,870,882
1953*	1,064,362,673	131,531,287	318,677,141

*December 1953 figures are estimated.

MATS TONNAGE

	Passengers	Patients	Cargo & Mail Tons	Total Tons
June 1, 1948-Dec. 31, 1951	980,972	157,028	199,000	326,000
1952	495,491*	62,352	86,643*	147,720
1953**	471,012	58,304	82,115	136,029

*After August 1952, ZI passengers, cargo and mail, total tons ARE NOT included. ZI patients are included.

**December 1953 figures are estimated.

To the Employee Relations Director of every American company

LET'S FACE IT . . . the threat of war and the atom bomb has become a real part of our life—and will be with us for years. Fires, tornadoes and other disasters, too, may strike without warning.

The very lives of your employees are at stake. Yours is a grave responsibility. Consider what may happen.

When the emergency comes, everybody's going to need help at the same time. It may be hours before outside aid reaches you. The best chance of survival for your workers—and the fastest way to get back into production—is to know what to do and be ready to do it. To be unprepared is to gamble with human lives. Disaster may happen TOMORROW. Insist that these simple precautions are taken TODAY:

☐ **Call your local** Civil Defense Director. He'll help you set up a plan for your offices and plant—a plan that's safer, because it's entirely integrated with community Civil Defense action.

☐ **Check contents** and locations of first-aid kits. Be sure they're adequate and up to date. Here again, your CD Director can help—with advice on supplies needed for injuries due to blast, radiation, etc.

☐ **Encourage personnel** to attend Red Cross First Aid Training Courses.

☐ **Encourage your staff** and your community to have their homes prepared. Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Your CD Director can show you ads that you can sponsor locally. Set the standard of preparedness in your plant city. There's no better way of building prestige and good employee relations—and no greater way of helping America.

Act now . . . check off these four simple points . . . before it's too late.

GRUMMAN COUGAR touching down on carrier deck symbolizes postwar technical advances in carrier-based aircraft designs.

■ NAVY

Naval Aviation Makes Rapid Progress

New developments in anti-submarine warfare, VTO interceptors and helicopters spur jet-propelled resurgence of carrier-based airpower.

Naval aviation, after lagging behind in the development and production of new aircraft, during 1953 made rapid gains and today 70% of the planes in the Navy's 16 carrier air groups are jet-powered.

Developments during the year include:

• **Vertical takeoff interceptors.** Three years ago the Navy held a design competition for VTO interceptors and contracts were awarded to Convair and Lockheed. The Convair model, XFY-1, is a delta-wing aircraft; Lockheed's XFV-1 is a straight-wing model. The XFV-1 has already flown horizontally and Navy plans vertical test flights soon. Both are powered by the Allison T40 turboprop rated at 5,500 eshp. with contra-rotating propellers. The planes do not require any other power for takeoff. If the plane lives up to expectations, Navy feels VTOs could be the greatest advancement in fighter aircraft since the jet engine. A major role for VTOs in convoy duty, close-support work and air defense is forecast.

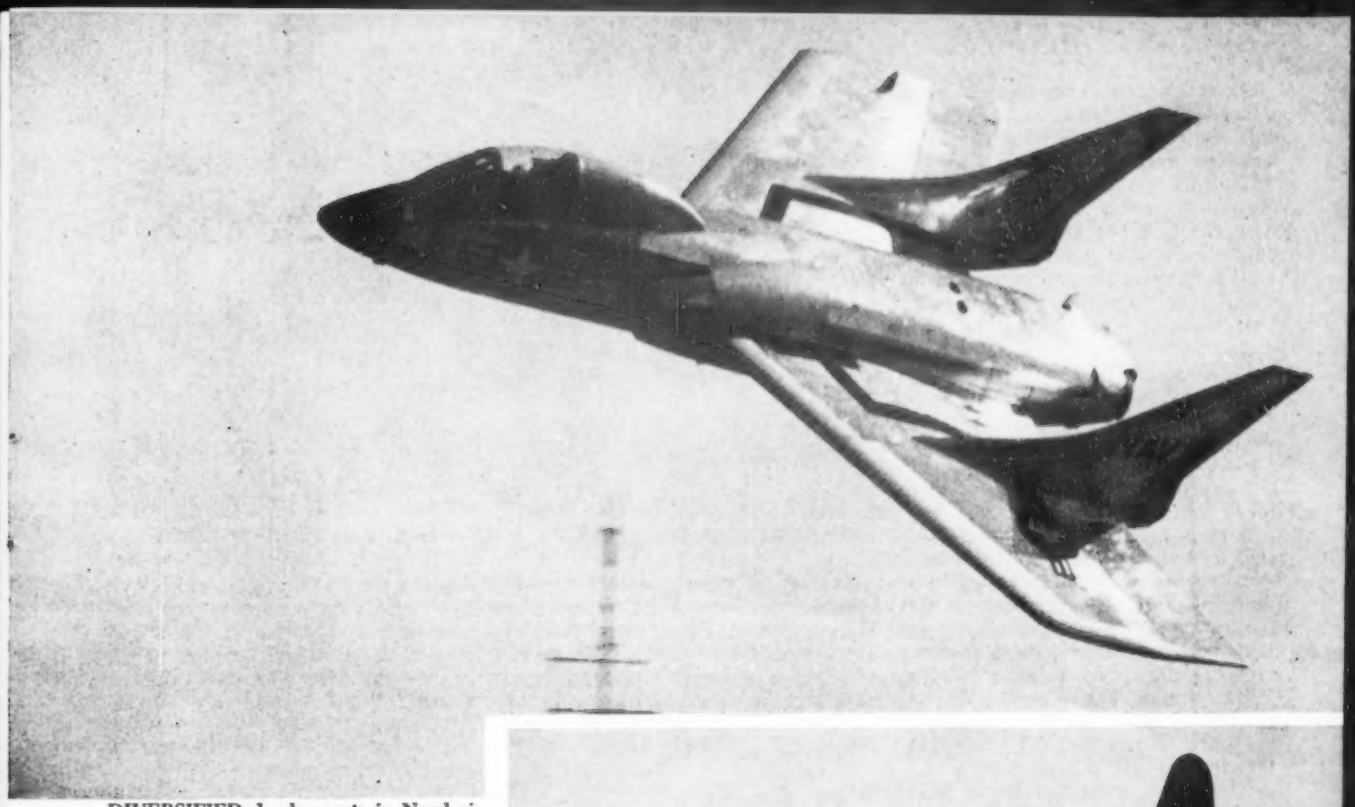
• **Douglas F4D Skyray,** which will be coming into operational service with fleet units by the end of this year, set a world speed record of 752.9 mph. over the 1.863-mi. course at Thermal, Calif. The Skyray is Navy's blue chip fighter, and production models will be equipped with Pratt & Whitney Aircraft's J57 engine. Westinghouse engines were used in the prototype.

• **Powerplant difficulties eased.** Much of Navy's troubles in new planes came from technical problems with jet engines. The Westinghouse J40 engine will be replaced by the Allison J71, and while there is no engine planned to replace the Westinghouse J46, Navy is banking heavily on the P&WA J57 to drive its planes. P&WA's J75 and Curtiss-Wright's J67, still under design, are other engines Navy is watching closely. As far as powerplants are concerned, Navy feels it is "out of the woods."

NAVAL AIRCRAFT ON HAND 1953	
Operating USN	9,198
Operating USNR	1,686
Support	2,381
Reserve Stock	721
Miscellaneous	950
Total	14,936

• **Resurgence of water-based aircraft.** After a seven-year Navy hydrodynamic development program, the F2Y-1 Sea Dart made its first flight last April off San Diego Bay. Other major development in water-based aircraft is the four-engine R3Y Tradewind. Its highspeed blended-hull design has helped put it in a speed class with land-based aircraft. Both are Convair aircraft.

• **First F3H-1N Demon production model delivered to Navy.** The new dual-purpose, all-weather fighter and fighter-bomber is being built in quantity by McDonnell, and has undergone extensive carrier tests. The first 60 Demons will be powered by the Westing-



DIVERSIFIED developments in Naval air include tail-less Chance Vought F7U-3 to be phased out in favor of A2U.

house J40 with afterburner, but the remainder will have Allison J71 engines. Operational units will receive the F3H within a year. McDonnell is also building a Demon model capable of launching missiles.

• **Grumman S2F is now in production.** It is a "single-package" aircraft combining the hunt and attack functions of the AF-2S and the AF-2W for anti-submarine warfare.

• **Douglas A3D,** a twin-jet attack bomber, made its first production flight last fall. The plane's power comes from two J57-P1 engines, and provides the Navy with a highspeed long-range carrier-based aircraft. Squadrons will be equipped with the new bomber in less than a year. Although the Navy is quick to point out that nearly all naval aircraft have atomic bomb delivery capability, the A3D will have a major role in this vital assignment. It is now going through board of inspection and survey tests.

• **Operational deliveries of the Chance Vought F7U-3 are being made.** Although engine production difficulties snarled the Cutlass program, Navy is confident that the tail-less fighter will prove a versatile aircraft. A missile launching model is also being produced. Production of the F7U will be phased out sometime this year, and the A2U will be put on the line.

• **Helicopter emerged** from a purely

LOCKHEED P2V anti-submarine plane combines piston power with turbojets.

MARTIN P5M long-range patrol boat has high length-beam ratio hull.

"paper consideration" to the rank of a prime anti-submarine warfare factor, with current tests checking its mine-sweeping capabilities.

▶**Configuration Problem**—Navy's "orphan in the storm," as one officer called it, is the F2Y Sea Dart. Snags in its development during the past year led some high Navy brass to be pessimistic about its outcome. However, progress, though slow, is encouraging for such a radical new design.

Designed in 1951 the fast, water-based fighter has not met what some are now calling an unwise timetable set for it. Configuration of the hydro-ski landing gear is the big problem and changes are expected this year after rough water tests are completed.

Powerplant is also a problem. Powered by two Westinghouse J46 turbojets, the Sea Dart does not yet have sufficient thrust. Engineers on the project expect to see the aircraft go into production with a single engine, probably either the Pratt & Whitney J57 or Allison J71 turbojet. All are agreed that many problems remain to be solved before the F2Y is production bound.

Marines are interested in the delta, supersonic fighter as tactical air cover for amphibious or airborne assault. Big advantage of the ship to the Navy would be its flexibility and its minimum requirements for satisfactory base.

Glenn L. Martin too is working on another design of this type for Navy.

Strategy

Navy's role in today's global strategy is explained by Adm. Robert B. Carney, Chief of Naval Operations:

"Stated in its simplest terms, the Navy's traditional job has been, and still is, to gain and maintain control of the seas. More specifically, the U. S. Navy in conjunction with Allied naval forces must exercise positive control over those sea areas needed for our own uses and those other sea areas of critical importance to the enemy. The Navy will also have collateral tasks in support of the armies and air forces, and these additional responsibilities may be expected to increase with the Navy's ever-increasing range of tactical influence."

GRUMMAN F9F-6 with unpainted wing panels banks above Douglas F3D Skyknight.

New Carriers

The attack carrier force, composed of 16 air groups operating from 14 carriers is the backbone of Navy's striking power. Three classes of attack carriers are in operation today: The Midway, the Oriskany and the Essex classes. The Essex will be replaced within a year by the Hancock class, which is similar to the Essex but has the steam catapult and higher-capacity arresting gear. There are today three Midway carriers, nine Oriskany and five Essex-class ships operational.

▶**Four Forrestal Class**—The first of the Forrestal-class carriers is due to be completed in July 1955. Second Forrestal-class carrier, the Saratoga, is scheduled for completion in February 1956. Contract was let last month for construction of a third of this class, and Navy's fiscal 1955 appropriation request contains money for a fourth. Navy had planned to put atomic engines in the fourth carrier, but the idea has been abandoned and conventional engines will be used.

The four carriers will have canted decks which permit a two-runway system.

Navy says that in flight operations during the past months aboard the canted-deck carrier Antietam more than 5,000 landings were made during daylight, darkness and low visibility without a single barrier accident. The steam catapult, superior arresting gear and canted decks have had a strong effect on Naval aviation, permitting operation of supersonic fighters and attack planes from carriers.

Navy air groups range in size from about 70 to 110 planes, depending on the carrier they are working from and the group mission.

▶**Peak in 1955**—For aircraft procurement, Navy has adjusted its sights for the long pull. The peak of aircraft deliveries, once set at 300 per month by mid-1954, has been scaled down to

ANTI-SUBMARINE duties will be taken over by Grumman S2F, twin-engine plane replacing hunter-killer team of Grumman AF-2s.

FLIGHT REFUELING contact is made between probe of Grumman F9F and drogue trailing from North American AJ aerial tanker.

a peak delivery rate of 250 aircraft monthly to be reached early in 1955. The delivery rate then will decline slowly.

In pilot training, Navy is meeting its goal of 3,200 pilots for fiscal 1954, and 3,100 are scheduled to be trained during fiscal 1955. The loss of 100 is due to a drop in the number of foreign pilots being trained under MDAP.

The Marine Corps is allotted about 1,000 pilots from the training program and Navy gets about 1,900. Remainder are Coast Guard and MDAP pilots. Marine pilots man three wings assigned to the three Marine divisions.

ASW Progress

Big accomplishment during the past year in the accented anti-submarine warfare phase of naval air operations was the gradual development of the team concept between air, ship and submarine divisions. Members of the three groups are interdependent on each other in clearing the sea lanes, are now working more closely together than ever before. ASW has come of age.

Test of Navy's work in this field comes this spring in a gigantic Atlantic maneuver which officials say will prove that ASW is now finally getting its feet on the ground.

Start of deliveries at the end of 1953 of two different model helicopters specially designed for ASW work helped bring this about. These are the Bell HSL and Sikorsky S-58 copters. To date Navy hasn't found any other copters which meet its needs for ASW.

▶ **Assigned to Units**—The Bell copter is now in production and undergoing further tests at Patuxent Naval Air Station, Md. The first production models are being assigned to ASW units. After some delay the Sikorsky copter will soon join the fleet.

Both are equipped with avionic detection gear. Tests on the first few delivered to Navy prove the helicopter has a permanent role in this phase of naval air operations. Earlier copters were used experimentally, but their lack of power was their weakness.

Heavy strain exerted on engines in the dipping and hovering requirements of ASW copters requires more rugged powerplants than were available in earlier models.

▶ **Screening Operation**—Helicopters are to be used primarily in groups as convoy screens flying ahead of Navy convoys and as regular search and attack units. Navy looks forward to equipping later models with weapons which can destroy as well as detect enemy subs.

Experiments are being carried out at Panama City, Fla., to test the helicopter's capability as a minesweeper. Experiments are being run on dragging hook cables through the water to snag mine lines.

Complying with Navy's traditional habit of hanging everything possible on new aircraft to further experiments, sonobuoys are also being placed in the new carrier-berthed copters. This year will see the introduction of a British model sonobuoy, the T1946A, which will be used until Navy comes up with bigger, improved model. Present U. S.-made sonobuoys are non-directional and thus impractical in the present state of anti-sub warfare.

▶ **Sonobuoy's Role**—Accent has been placed on the use of sonobuoys in the past few years. Schnorkel submarines offer minute radar signals for standard airborne research radar. With sonobuoys, dropped into the water from the air, detection is simplified.

During the past year, the carrier-based Grumman S2F passed all its tests with flying colors and is now being introduced into the fleet as quickly as

TURBOPROP TRADEWIND is Convair R3Y, 80-ton, 350-mph. flying boat now under evaluation for logistic support of fleet units.

NAVY TRANSPORT for highspeed movements by air is Lockheed Super Constellation powered by Wright Turbo Compound R3350s.

Grumman can produce the twin-engined aircraft. The S2F made its first appearance in 1952. Last year's tests, including extensive flight trials aboard the USS Coral Sea in the summer, caused Navy to bank heavily on the ship. It is powered by two Wright R1820 Cyclone engines.

▶ **Neptunes**—Last year also saw the introduction of jet pods to the Lockheed P2V Neptune series of patrol bombers. This land-based aircraft has been fitted with two Westinghouse J34 turbojets, one under each wing, to supplement its two Wright Turbo Compound piston engines. This is probably Navy's final aircraft use of Westinghouse turbojets.

In the jet-modified version—the P2V-7—jets supplement piston power to speed the bomber to its target and home again. Over the enemy target, its compound engines—minus the turbojet thrust—hold the bomber to a slower speed. Navy sees the P2V-7 series useful for some time to come.

Another plane high in Navy's regard for ASW is the Martin P5M Marlin powered by two Wright R3350 Compound engines. A seaplane, the P5M went into squadron service in 1952 and last year was performing heavy duty. Navy's respect for the P5M points up the current resurgence of Navy thinking toward the seaplane. A new Martin seaplane, the P6M, is jet-powered and designed as a minelayer.

▶ **Duty for Blimps**—Blimps, the lighter-than-air craft which Navy has long used against subs, began last year to take over a vital role in the ASW program. Principal model now is the Goodyear ZP3K, which is heavily loaded with sonar and other detecting devices as well as torpedoes.

Earlier thinking on the blimp restricted its use to coastal areas. But with the increase in the size of the new models, they are acquiring greater range. The ZP3Ks are being given added responsibility for convoy protection, although few have been built thus far. An even bigger, longer-range blimp is the Nan, which is now being tested at Key West, Fla., indicating that Navy considers the blimp of ever-increasing importance.

▶ **Use 11 Carriers**—ASW carrier operations are carried on currently from the decks of five Essex-class carriers and six of the smaller "jeep"-type carriers, so named because of their size. The five Essex-class have not been converted to the angled-deck principle.

The canted-deck concept is not necessary for ASW operations. Present thinking is that the Essex-class carrier is as large as will be necessary.

▶ **Seaplane Tests**—In the increased emphasis on sea-based aircraft, Navy rolled out its Convair R3Y Tradewind cargo-passenger seaplane late in the year and the big ship made its initial flight tests last month.

Powered by four Allison T40 turboprops, the 80-ton long-range transport has a speed of more than 350 mph. Observers believe it will have important commercial applications.

Navy experts expect great things from the R3Y as logistic support for the fleet. Evaluation flights will be continued throughout the next several months in San Diego Bay, after which the ship will be flown to Patuxent, Md., for further tests.

Present success of the sea-based aircraft will bring development this year in special equipment and housing for servicing all water-based aircraft, assuring that type of aircraft a place in Navy's sun for years to come.

U. S. NAVY AIRCRAFT

Company	Plane	Name
Cessna	OE	Bird Dog
Chance Vought	F7U-3	Cutlass
	F7U-3M	Cutlass
	F7U-3P	Cutlass
	A2U	Cutlass
Convair	F2Y	Sea Dart
	R3Y	Tradewind
Douglas	F4D-1	Skyray
	F4D-2	Skyray
	AD-5	Skyraider
	AD-5N	Skyraider
	AD-5S,W	Skyraider
	AD	Skyraider
	A2D-1	Skyshark
	A4D-1	.....
	A3D-1	Skywarrior
Grumman	F9F-6	Cougar
	F9F-6P	Cougar
	F9F-7	Cougar
	F9F-8	.....
	F9F-9P	.....
	S2F-1	.....
	UF-1	Albatross
Lockheed	R7V-1	.....
	R7V-2	.....
	WV-3	.....
	P2V-5	Neptune
	P2V-7	Neptune
	TV-2	.....
Martin	P5M-1	Marlin
	P5M-2	Marlin
McDonnell	F3H-1N	Demon
	F3H-2N	Demon
	F3H-2M	Demon
	F3H-2P	Demon
North American	FJ-2	Fury
	FJ-3	Fury
	FJ-4	Fury
	AJ-2	Savage
	T-28B	.....

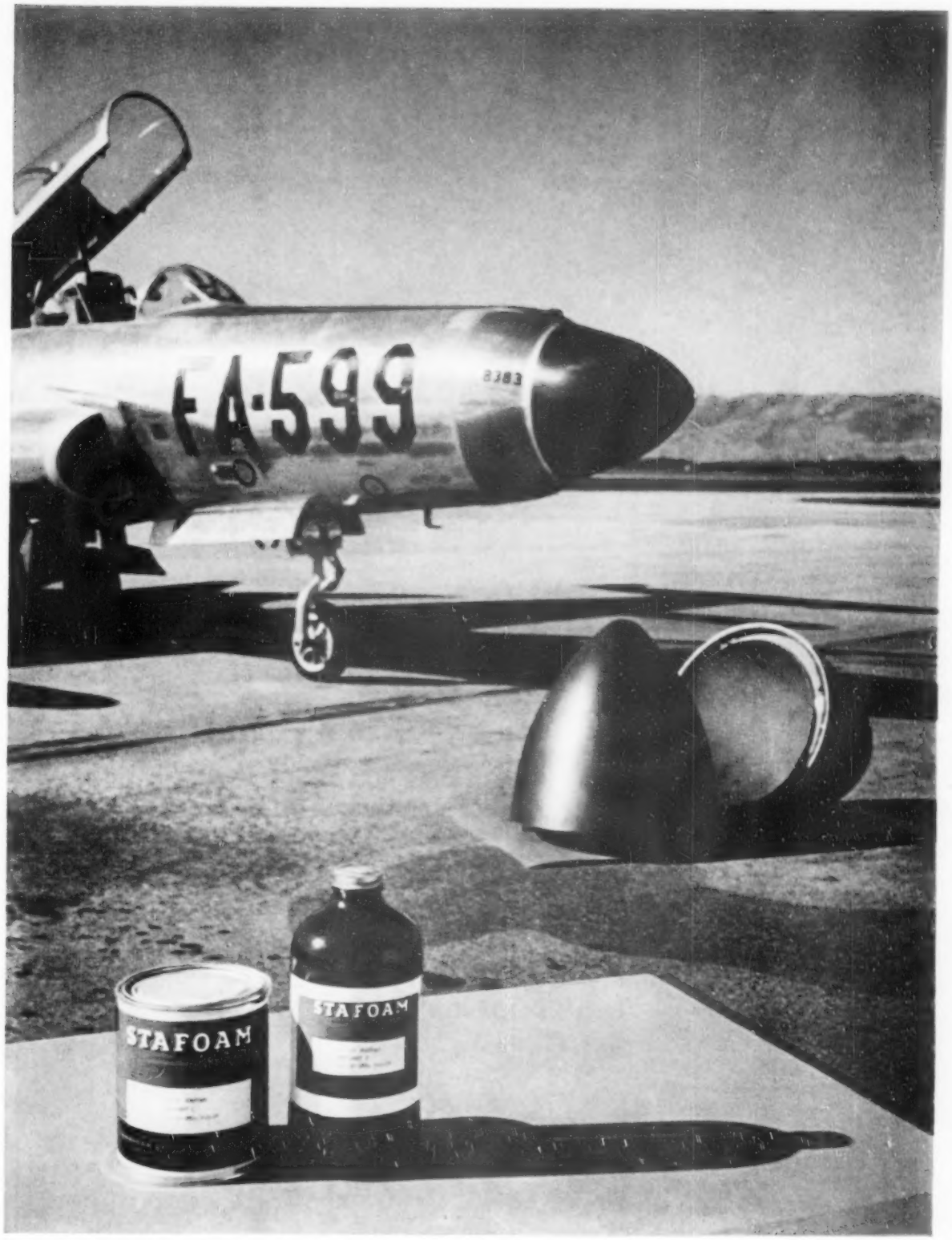
HELICOPTERS

Bell	HSL	.....
Hiller	HTE	.....
Kaman	HOK-1	.....
Piasecki	HUP-2	Rescuer
	HUP-2S	.....
Sikorsky	HUS-1	.....
	HO4S-3	.....
	HR2S-3	.....

BLIMPS

Goodyear	ZP2N-1W	.....
	ZP4K	.....
	ZP5K	.....

Source: U. S. Navy



AMERICAN LATEX' NEW STAFOAM

"Plastic Surgery" for the most sensitive nose in the world (see next page)

Stafoam Plastic Allows Radar Energy Transmission Up to 99% in F-94C Radome

With deadly accuracy, Lockheed's sleek Starfire can automatically aim and fire up to 48 rockets, any one of which could knock out the biggest bomber flying. The bullet shaped radome, or nose, houses the sensitive radar scanner that tracks down the prey. Its effectiveness in allowing the radar beam to pass through unimpeded is due to the use of Stafoam in the construction of the radome itself.

Inexpensive Stafoam Provides Sufficient Strength and Rigidity to Radome Yet Offers Negligible Resistance to Radar Beam—

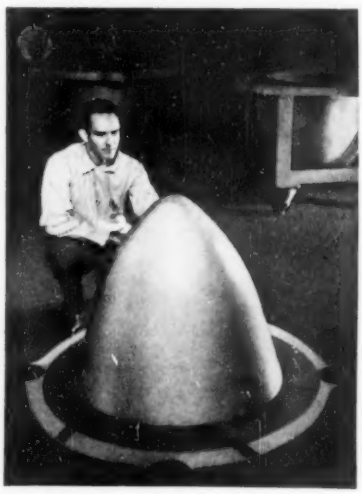
The terrific rocket fire power of Lockheed's super F-94C fighter (48 rockets including wing pods) would be largely wasted without the sensitive, critically accurate radar firing mechanism housed in the radome.

The radome itself must be manufactured with infinite precision to allow the radar scanner installed inside of it to operate effectively. Most important, the materials used for the radome must, of necessity, allow the electrical magnetic beam to pass through without being deflected, distorted or impeded. The radome can be compared to an optical lens—where the physical characteristics of the material influence the efficiency in the transmission of rays.

Stafoam is poured into a mold lined with thin fiberglas polyester shells. After the Stafoam solidifies and is cured, it is securely bonded to the fiberglas laminates forming a light weight rugged sandwich about 3/10 inch thick.

Stafoam Now Used In Structural, Insulation and Safety Fields

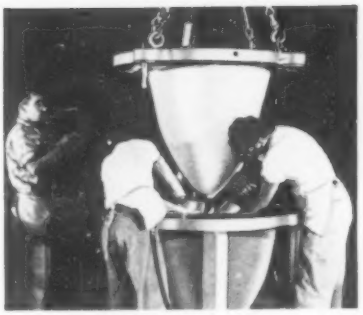
In addition to its structural use for aircraft construction the many varied types of Stafoam make it applicable to almost every other industry. Its limitless range of hard to soft forms and its slow flex recovery, make it especially suited to the impact and collision field. Also, because of its low thermal conductivity rate it is superior for insulation.



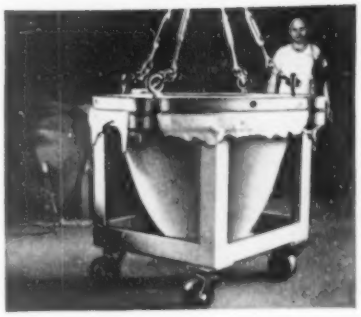
The bullet shaped radome, just removed from the mold, holds the exact contour during curing. The close tolerances required for its effectiveness make little allowance for shrinkage or expansion.

Stafoam is Easy to Mix and Pour

One of the most remarkable characteristics of Stafoam is its simplicity of application. By merely pouring the contents of one container of a given formulation into another container, and gently mixing for several seconds, the correct balance is obtained for the exact consistency and density desired. And, it never varies. By following the very simple directions, any non-skilled employee may apply Stafoam to your product. With Stafoam, there is no measuring of ingredients necessary. The exact proportion of the two ingredients can be predetermined by American Latex for you – and packaged ready to mix and pour. Some formulations allow for self curing, thus eliminating the necessity for costly ovens.



In spite of the critical tolerances allowed in the finished radome, its construction can easily be handled by non-skilled help. Here two employees are pouring liquid Stafoam into mold. Within seconds after male die is lowered into mold, foaming takes place.



Sudsy Stafoam can be seen foaming from the sides of the mold. Within a very few minutes it starts to set. Complete curing takes about a twenty-hour cycle. The Stafoam bonds the two thin layers of fiberglas laminates together.

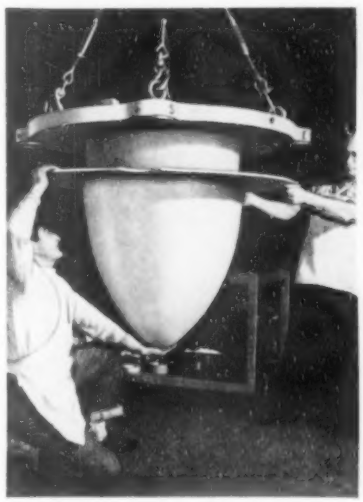
Lockheed Tests Prove Stafoam Has Exceptional Strength to Weight Ratio

Because of Stafoam's superior strength to weight ratio, Lockheed Aircraft Corporation has now found many well suited uses for it. A few of its current applications at Lockheed are: structural filler for rocket exit doors, radomes, aileron filler, antenna housing, shock boards, underwing fillets, reflector beam assembly and others. Unlike many foam products, the cell structure of Stafoam is of a non-connecting type, making it stronger, buoyant and moisture-resistant.

Stafoam is Self Bonding to Most Materials

The bonding qualities of Stafoam during curing eliminate the tendency to "pull away" from the surfaces surrounding it. This important feature not only makes Stafoam a superior insulating substance, but more important, it becomes an integral part of a structural unit. Loads are distributed equally, thus adding tremendous strength to any unit containing Stafoam.

The bonding quality of Stafoam is another reason why it is perfectly adapted to Lockheed's F94C radome. It combines the two fiberglas laminates into a single lightweight unit.



After a two-hour curing period in the mold, the radome can be removed for post-curing.

NOTICE!

Although the information contained in this advertisement covers only one application, Stafoam is supplied in hundreds of densities, textures hard and soft with applications for almost every industry.

Some formulations allow self curing, others provide for heat resistance in excess of 300° F.

For more general information on this truly versatile foam plastic, write for our Stafoam brochure at the following address.

American Latex Products Corp.
PLASTICS DIVISION
3341 West El Segundo Boulevard
Hawthorne, California

STAFOAM, a registered trademark of American Latex Products Corp., is manufactured under *LOCKFOAM patents owned by Lockheed Aircraft Corp., Burbank, Calif.
**Registered Trademark of Lockheed Aircraft Corporation*

American Latex Products **CORPORATION**

3341 West El Segundo Boulevard • Hawthorne, California
San Francisco: 42 Gough Street • Seattle: 2231 Fifth Avenue

"O. K. To Jettison!"

The force ejection pylon designed, developed, and produced by Pastushin assures safe, positive ejection of jettisonable fuel tanks and other external stores at any speed or possible flight attitude.

PASTUSHIN **AVIATION CORP. • Los Angeles, California**

RESEARCH • DESIGN • DEVELOPMENT • PRODUCTION

Unusual opportunities for engineers! Submit resume.

DOUGLAS GLOBEMASTER provides air mobility for heavy Army equipment including tanks, heavy artillery, bulldozers and trucks.

Army Puts New Stress on Air Mobility

ARMY HELICOPTER squadrons bring swift supply to combat troops in rough terrain.

FIELD TELEPHONE wire can be laid at 120 mph. from copters or liaison planes.

By G. J. McAllister

A new concept welding airpower strategically and tactically to ground forces and their equipment is rapidly gaining favor in the Army's staff councils.

The concept embraces two distinct missions:

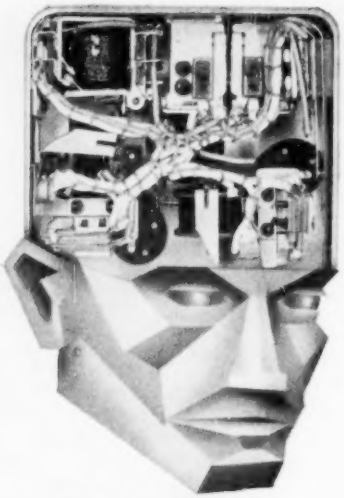
• **The strategic airlift.** This provides for air transport of troops and equipment over long distances, giving the Army a strategic mobility that goes beyond the tactical air drop. The airlift task would be carried out by the Air Force.

• **The tactical airlift.** This mission, confined to the ground fighting zone, is handled by Army aircraft under the direction of the Army field commander and calls for short-range helicopter lift of men and supplies. In addition, observation, reconnaissance, casualty evacuation and such operations as wire-laying are part of the task.

The strategic airlift concept was pushed effectively by Earl D. Johnson, an imaginative and forceful airpower advocate, when he was named to the Army secretariat in 1950. Johnson is now president of the Air Transport Assn.

▶ **"Three for One"**—"The key to our plans must be mobility—fast, dependable, ever-present capacity for mobility—land, sea and air mobility—mobility which is capable of confusing and outstripping enemy intelligence," Johnson believes.

"We need—and dreadfully need—the



Brain Boxes
by Cook

Mass Producers of Electronic Intelligence for America's Aircraft, Guided Missiles, Armament, and Industry presents a winning combination

RELAYS – SENSING DEVICES
TIME DELAYS – FINE INSTRUMENTS
400 CYCLE COMPONENTS
and associated apparatus, developed and produced by the
DIAPHLEX DIVISION

Comprehensive Electronic Systems prototyped by
COOK RESEARCH LABORATORIES
staffed with 350 scientists, engineers, technicians, draftsmen, and model makers.

Electronic Gear mass produced by the
ELECTRONIC SYSTEMS DIVISION

Qualified and completely Acceptance Tested by
INLAND TESTING LABORATORIES

A team coached and directed by management who know their jobs, stay on the job and get results.

We invite your inquiry.

Cook Electric Company
Established 1897
2700 Southport, Chicago 14, Illinois

Diaphlex—Aircraft Components and Accessories • **Wirecom**—Wire Communications, Protection & Distribution Apparatus • **Magnilastic**—Expansion Joints, Heavy Industry Equipment, and Airframe Structures • **Cook Research Laboratories**—8100 Monticello Avenue, Skokie, Illinois • **MetalFusion**—Heat Treating, Brazing and Annealing • **Inland Testing Laboratories**—1457 Diversey Parkway, Chicago 14, Illinois • **Electronic Systems Division**—3413 W Belmont Avenue, Chicago 18, Illinois • **Subsidiary: Canadian Diaphlex Limited**—Aircraft Components and Accessories, Toronto, Ontario, Canada

CONVERTIPLANES like McDonnell XV-1 are Army's hope for frontline liaison work.

capacity to deliver relatively powerful forces of men and materiel rapidly to any part of the world. The concept of envelopment—the tactical end run—in battle must be freed from the limitations of mud, mountains, morasses, yes, and even roads," Johnson says. "It must be a surprise action which is a vertical or horizontal movement over all types of terrain by means of which our ground forces can be augmented, withdrawn, or redisposed rapidly.

"In short, we must be able to hit our enemy three times for each blow we receive. This, you will readily see, in effect increases our relatively limited manpower resources at least threefold."

Johnson puts his finger squarely on the basic strategy: "People are always saying that we should take the initiative—that we should force any potential enemy to meet us on our terms, rather than for us to meet them on theirs. I agree with them, but, believe me, it is extremely difficult to achieve this initiative, particularly when we have dedicated ourselves to the maintenance of the peace and have knowingly denied ourselves the right to initiate war.

"This means we have denied ourselves the right of saying when, where, and, to some extent, how a war will be fought. I say to 'some extent how,' because I believe that if we mechanize our forces and provide them with the mobility which airpower alone can achieve, to that extent we control the how."

▶ **Army Views**—Army aviation backers see it this way:

• **The tactical air drop mission** has defects which would be overcome by linking the strategic airlift—the long move—and the use of the Army's organic aviation—the short move.

• **The helicopter tactical airlift** can be carried out promptly in any weather with greater safety. An airborne unit in an overseas theater is always a target of enemy intelligence. Its commanders require a minimum of 45 days in which to plan and execute a drop, and airborne troops require special training and equipment. Army points out that their organic helicopters will lift quickly any required troops, whether paratroopers or not, to any spot point in the combat zone.

Positive indication that the Army is tailoring its forces to the strategic airlift concept is evident in its research and development program. A major part of the research effort is directed toward lighter, less bulky models of

CESSNA L-19 makes pickup of message from ground forces in field.

# of all the electronic auto pilots in use

on American-manufactured,* scheduled, commercial carriers in world-wide operation

63%

are *Eclipse-Pioneer*

Look at the facts for the answer to which auto pilot is best. On world-wide, scheduled, commercial carriers of American manufacture . . . where profitable operation is a "must" . . . more than 6 out of every 10 electronic auto pilots are Eclipse-Pioneer. Back of this long-time preference stand these very sound reasons:

- **Eclipse-Pioneer is first in electronic auto pilot experience.** E-P not only produced and installed the first all-electric auto pilot on a commercial plane, but has continued to show the way ever since in auto pilot design, development, and manufacture . . . including production and delivery of *thousands* for military aircraft.
- **Eclipse-Pioneer auto pilots suit a wide range of aircraft.** They're used on every type plane from jet fighters to 4-engine transports . . . including executive and new, long-fuselage, high-performance aircraft.
- **Eclipse-Pioneer auto pilots also offer Flight Path Control (automatic approach).** The addition of FPC provides the complete all-weather answer to automatic approaches and to cross-country flying on VHF *omnirange*. Three airlines are already flying with FPC . . . a number of others are flight-testing it . . . and 56 transport-type aircraft employed in flight-checking all ILS approach installations throughout the continental United States and its possessions are equipped with the full system.

The leadership enjoyed by E-P Auto Pilots is a tribute to the engineering genius and specialized facilities that are so distinctively Eclipse-Pioneer.

*Eclipse-Pioneer Auto Pilots have also been specified for certain foreign-built new transports.

Eclipse-Pioneer

TETERBORO, NEW JERSEY • DIVISION OF Bendix AVIATION CORPORATION

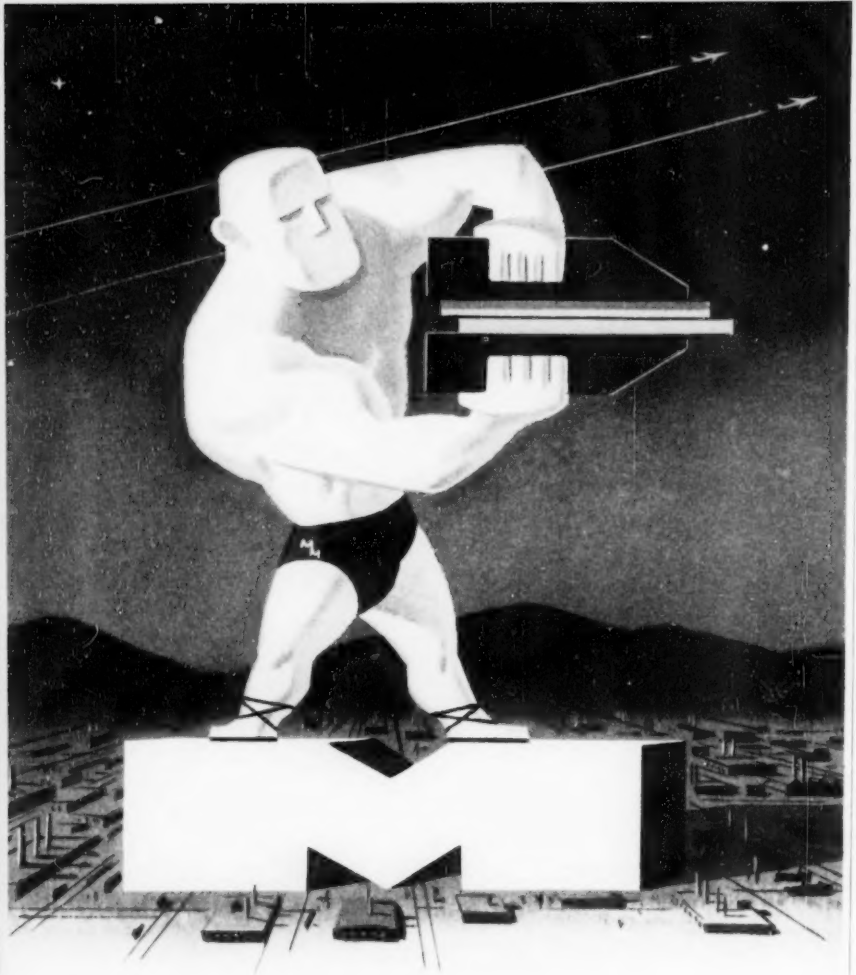
West Coast Office: 117 E. Providencia, Burbank, Calif.
Export Sales: Bendix International Division
205 East 42nd St., New York 17, N. Y.

PRECISION PRODUCTS* MADE BY ECLIPSE-PIONEER

- Automatic Flight Systems
- Airplane and Engine Instruments
- Flight and Navigation Instruments
- Power Supply Equipment
- Air Pressurization and Ice Elimination Equipment
- Engine Starting Equipment
- Air Turbine-Driven Accessories
- Oxygen Equipment
- Precision Components for Servomechanism and Computing Equipment
- Sand, Permanent Mold and Die Castings of Magnesium and Aluminum
- Plaster Mold Castings

*Manufacturing capacity is now available for a great many models of these products.

World's Largest Producer of Aviation Instruments and Accessories



Presenting **"MIGHTY MO"**

...a new symbol for Monogram Quality

In sheet metal clamps and applying tools, Monogram stands for the very finest...and "Mighty Mo" stands for Monogram. To be sure of the high quality that "Mighty Mo" represents, specify Monogram when ordering safety clamps.

"MIGHTY MO"

MONOGRAM

MANUFACTURING COMPANY

8557 Higuera Street, Culver City, California

present materiel that Army employs.

The Corps of Engineers has developed a "family" of air transportable equipment. Bulldozers, graders, carryalls and air compressors have been redesigned to the present capabilities of airlift. Experiments in the air drop of such equipment have been only partially successful. In the metals field, titanium with its strength, lightness and resistance to corrosion is under intensive study. Half the weight of steel and possessing the same strength, titanium models of such basic infantry equipment as mortar baseplates have been produced. Prospects for titanium fabrication of vehicles are excellent.

▶ **Concern Over Cut**—The Army is disturbed over the recent "new look" decision that cut the troop carrier wings to 11 from the 17 contained in the former USAF 143-wing force. Army has been pressing for an increase in the original 17-wing goal for troop carriers. With a cut in both manpower and airlift wings, the Army is deeply concerned over its ability to meet its global tasks since the present strategy is to make up the lack of numerical advantage through superior mobility.

Air Force today is procuring the C-119 and the C-123B from Fairchild, the C-118 and C-124 from Douglas, and the C-130 from Lockheed. Progress of the 100,000-lb.-payload prototype (XC-132 turboprop) Douglas is building is being followed closely.

USAF at the secretariat level is also studying the effect of airlift on logistics.

▶ **Cuts Time, Cost**—Assistant Secretary of the Air Force Roger Lewis says:

"The Air Force is doing a great deal of work in the logistics field. An essential ingredient of airpower is, of course, mobility, and since United States airpower has become global in scope, we find that there is much to be done and we are attacking the problem with great energy. For example, under the usual military supply formula, the engine pipeline from manufacturer to depot across the seas and from depot to user is about 200 days. The current cost for jet engines makes 200 days' supply represent quite an investment and provides the opportunity for real reduction in the cost of military operations.

"Improved procedures, better equipment, and airlift instead of transport by surface promise not only enormous economies in materiel but greater mobility as well.

"For every four tons shipped to the field only about one ton constitutes actual supplies. The balance is in packaging and crating. Better crating or, better yet, no crating at all where air movement can be counted upon, offer means of great savings to the taxpayer for more airpower at a lower cost."

► **Evacuated 16,000 Wounded**—With new metals and new concepts for ultimate utilization of aircraft, Army today is busy studying the great lessons of Korean operations. Army pilots flew 500,000 hr. in Korea in undertaking 140,000 combat missions of reconnaissance and artillery spotting. Army aircraft lifted 16,000 casualties from the battlefield.

A narrative diary of the operations of the 6th Helicopter Co. in Korea using H-19s relates the capabilities of Army aviation:

". . . It became the duty of the unit to supply three regiments on the line with food, fuel and ammunition for a period of three days. Fourteen helicopters broke ground . . . flying through rain squalls. The choppers made 150 roundtrips to and from the nine drop sites in the front lines. . . .

"Totals showed that one helicopter company—not even full strength—had hauled an astounding 622,684 lb. of supplies. They had winged their ways through 1,486 relays between the division supply points and the frontline doughboys. . . ."

► **Today's Lineup**—Army aviation today is based on four types of aircraft:

- **Two-place fixed-wing (L-19).**
- **Multi-passenger fixed-wing (L-20).**
- **Utility helicopter (H-13, H-23, H-25).**
- **Cargo helicopter (H-9, H-21, H-37).**

Assignment of these aircraft to divisions breaks down to 13 two-place fixed-wing planes, three multi-passenger fixed-wing craft and 10 utility helicopters for each division. These aircraft are used to provide reconnaissance for the division commander and staff, emergency aerial resupply and transportation to other headquarters.

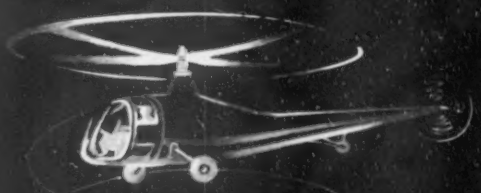
► **Third Dimension**—In addition, nondivisional units such as engineer combat groups, corps artillery headquarters batteries and transportation helicopter companies are provided with organic aircraft. Largest number goes to the transportation helicopter companies, which have 21 cargo helicopters each. Army has an inventory of about 3,000 aircraft.

Use of Army aircraft has added a vital third dimension to the Army mission. Helicopters have proven extremely valuable in engineer survey operations where they are used to select triangulation points and transport parties to inaccessible locations. One helicopter operating with a survey party in Alaska last summer permitted to party to accomplish work in one day that otherwise would have required 20 days to perform, an Army report shows.

Use of aircraft with armored units is a major means of controlling tank operations, and provides aerial flank security patrols that release ground units from this assignment.

► **Wire Laying**—The Signal Corps has

...thermal sensing unit



C·P·I PLUGSTAT®

—wherever temperature limit indication is required

CPI PLUGSTATS provide precise thermal warning without calibration drift. Small physical size has been combined with rugged construction. Special alloy contacts assure clean make-and-break. Capable of 200°F overshoot from high or low normal setting. Available also with AN connector. Rated at ¼ ampere, 28 volts, AC or DC resistive loads. Contacts NO or NC. Weight approx. 1.5oz.

Proven dependable in—
AIRCRAFT GENERATORS
AIR COOLED ENGINES
WATER COOLED ENGINES
TRUCK REAR ENDS
MARINE ENGINES
BEARINGS
PIPED LIQUIDS
GEAR BOXES

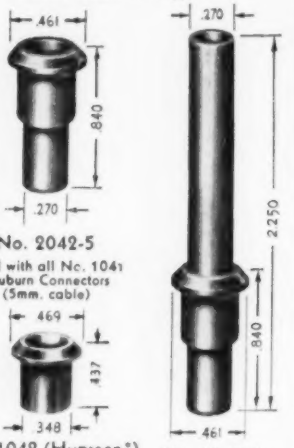
CONTROL PRODUCTS INC

328 SUSSEX STREET
HARRISON, NEW JERSEY

Auburn IGNITION ACCESSORIES

Terminal Collars (Seals)

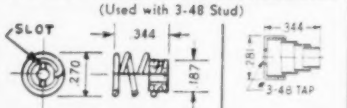
Ozone Resistant Hypreen*



*Auburn Synthetic Rubber

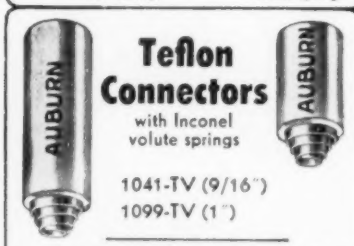
SPRING AND EYELET ASSEMBLIES

(Used with 3-48 Stud)



Teflon Connectors

with Inconel volute springs



1041-TV (9/16")
1099-TV (1")

Connectors with stainless steel coil springs

1041-C Steatite
1041-M Mycalex
1041-D Alumina
(AN 4164-2)

1041

1099-C Steatite
1099-M Mycalex
1099-F Phenolic
1099-D Alumina
(AN 4164-1)

1099

AUBURN SPARK PLUG
Co. Inc., Auburn, N.Y.

BELL LIAISON copters scout the enemy and direct movements of Army tanks.

developed the technique of laying wire by liaison planes and helicopters. The extensive telephone net required by field forces involves a rugged support operation for the men who must put down wire across mountains and other forbidding, dangerous terrain. Helicopters today can lay wire across any terrain at speeds up to 100 mph.

Experiments are being conducted today to put the poles in by helicopter with metal prongs spearing the poles into the earth after being dropped.

In Korea, a Signal Corps battalion commander estimated that one aircraft permitted him to take 20 jeeps off the road for messenger service.

Army is putting its blue chips on the helicopter, particularly the H-37, which can carry 28 fully-equipped men into battle. They are sharing Sikorsky's output with the Marine Corps.

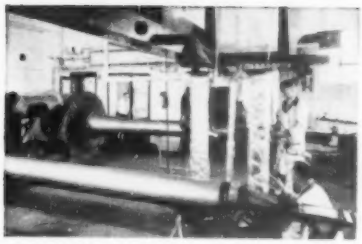
Convertiplane research has been spurred by Army funds financing the XV-1, XV-2 and XV-3 projects.

► **Observation Solution**—"The convertiplane today is strictly a research aircraft," says Lt. Col. Robert R. Williams, chief of the Army Aviation Section, G-3 (Operations). "But already we see it as an excellent solution to our observation aircraft problem—a plane that can take off in zero space and have the forward speed advantage of fixed-wing aircraft. We do not see the convertiplane today replacing the cargo helicopter."

The Army has its own pilot corps to fly its aircraft. To meet this demand—currently about 1,000 a year—Army trains company grade officers already experienced in their basic arms such as artillery, infantry, engineer. The Army figures that most of its missions call for flyers with a background of experience in the operations served by Army planes. These pilots are given frequent tours of ground duty to provide them with opportunities to keep up with progress in their basic arms.

There are still several areas of USAF-Army relationships that require closer coordination. Army feels it should control its aviation research, development and procurement. It is also dependent on USAF for tactical air support and the bulk of airlift required to provide genuine mobility.

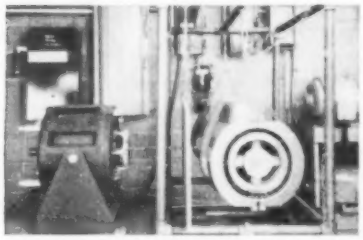
DE HAVILLAND BEAVERS proved workhorse liaison plane in rugged Korea.



Heat balances, heater life tests, and testing of large capacity combustion systems are carried on in this special new laboratory at Janitrol's Columbus plant.

Soundproofed viewing and instrumentation room for lab (top left) is completely equipped to control and record complete data on equipment under test.

Mum's the word here. In this quiet completely grounded room, radio noise suppression tests and development work on shielding of ignition equipment for Janitrol heaters is accomplished under ideal circumstances.



Test setup to determine the effects of vibration on aircraft heaters. In this special lab section, displacements as large as one inch and accelerations as high as 1,000 g vector can be imposed on the test unit.

what goes on here?

—and in the background, main test area where heating equipment is tested and proved under simulated service conditions. Only a few of the testing facilities are pictured here. Fundamental research at Surface Combustion's Toledo, Ohio plant begins the solution of many aircraft combustion problems literally before they arise. Nor can we overlook the application experience of Janitrol's field engineers. Janitrol—in at the design stage—solves aircraft combustion and heat transfer problems faster and better.

Janitrol

KNOWN THE WORLD ROUND

AIRCRAFT-AUTOMOTIVE DIVISION, SURFACE COMBUSTION CORPORATION, COLUMBUS 16, OHIO

National Sales, Engineering, Production Headquarters, 400 Dublin Ave., Columbus 16, Ohio. District Engineering Offices: New York, 225 Broadway; Washington, D. C., 4650 East-West Highway; Kansas City, 2201 Grand Ave.; Ft. Worth, 2509 West Berry St.; Hollywood, Calif., 7046 Hollywood Blvd.; Columbus, Ohio, 400 Dublin Ave. Executive Offices: 2375 Dorr St., Toledo 1, Ohio.

AVOID 3000-PSI SYSTEM TROUBLE . . .

Use Parker's air receiver

"Here are two 3000-psi aircraft *system components.* You'll want to know all about . . . a lightweight air receiver and a high-performance accumulator," says Bud Knox, Manager of the Hydraulic Valve Division at Parker Aircraft Co. "Let me show you why:

"For pneumatic systems, Parker's new air receivers are safe and durable. They passed the .50-caliber gun-fire test without deviation. Although they're built entirely of 4130 steel, it's the way they're made that is the secret.

"The 100 cu. in. production unit weighs only 4.2 lbs. and the 200 only 8.8 lbs. Other sizes will soon follow.

"For any application where you need stored high-pressure gas . . . pneumatic systems, emergency systems, purging, or the like, why not use these new Parker units?

"For hydraulic systems, Parker's accumulators have been proved in over two years' service.

"The balanced inner-cylinder carries the piston and seal. Air pressure is applied equally to both sides of the inner-cylinder wall. Thus, the piston moves in a cylinder that always stays exactly the same diameter over its entire length. There can be no breathing to cause excessive O-ring wear. Leakage is practically eliminated.

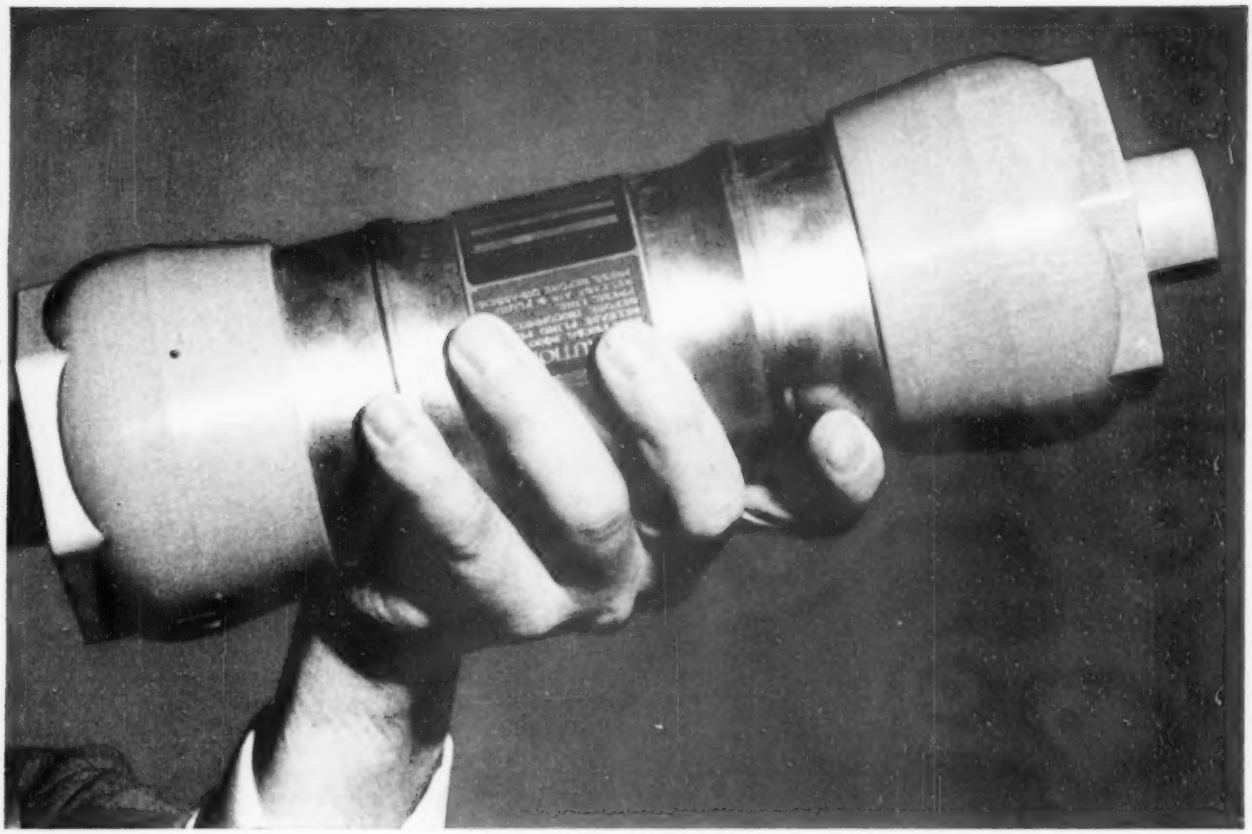
"Parker accumulators meet *all* of the requirements of Specification MIL-A-5498, *Revision B.* All standard sizes are now in production."

Mail the coupon for complete details about either the air receiver or accumulator.

PARKER AIRCRAFT CO., 5827 W. Century Boulevard, Los Angeles 45, California
(Subsidiary of The Parker Appliance Company)

Parker

Hydraulic and fluid system components



and hydraulic accumulator

What other Parker components for hydraulic and fuel systems interest you? Parker Aircraft Co. builds a wide variety of products for many different applications.

Send to Parker Aircraft Co. all inquiries for *aircraft* components. Both sales and engineering are now at this one location . . . offering faster service.

PARKER AIRCRAFT CO.
Section 803-C
5827 W. Century Boulevard
Los Angeles 45, California

Please send me the following information:

☐ Parker air receiver Catalog, File No. 1358

☐ Parker aircraft hydraulic accumulator Catalog, File No. 1356

☐ Information about these other specific aircraft fuel or hydraulic products: _____

_____

NAME _____

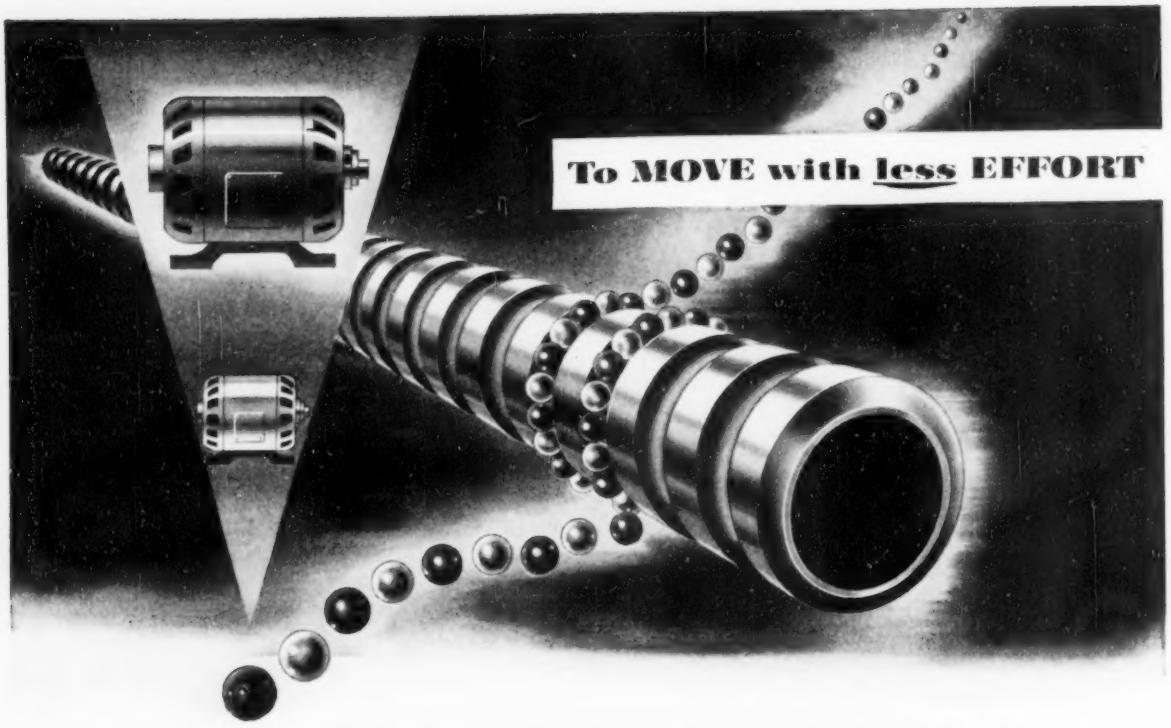
TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

Mail this coupon today! Send for complete technical details about the new Parker high-pressure air receiver, hydraulic accumulator, or other products.



WE'VE DISCOVERED HOW TO

Shrink your motors

-by Floating a screw on a stream of balls!

We eliminate the need for the excess power that was added to overcome friction in the old-fashioned screw-type drives.

Ball-screw actuators made by Cleveland Pneumatic have an efficiency as high as 90% on most types of drives for machines. This lets you use a ½-horsepower motor instead of a 1-horse... a 5-horse instead of a 10... with power to spare.

It's done by replacing the famous old high-friction Acme thread principle with a spiral ball-bearing thread that does wonders for efficiency. Sliding friction is replaced by the rolling action of the screw and nut over the steel balls in the threads.

These "AEROL" Ball-Screw Actuators are at work *now*... in the air at scores of spots on aircraft; on the ground in machine tools, in research equipment, on trucks and cars; at secret locations on difficult defense projects.

We can also cut down friction in *your* designs and products... by shrinking the size of motors, easing the effort it takes to hand-actuate a device, making equipment move faster yet come to a more precise stopping point under any condition. Our Actuators operate smoothly under the greatest extremes of heat and cold.

When can we discuss with you the application of our AEROL Ball-Screw Actuators in your business? If you wish to know more about Cleveland Pneumatic Actuators and their uses... write for our booklet.

Cleveland Pneumatic
Tool Company CLEVELAND 5, OHIO

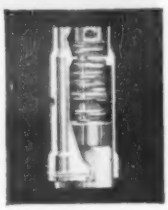
Department C-3

BALL-SCREW ACTUATORS • AIR-OIL IMPACT ABSORBERS

World's Largest Manufacturer of Aircraft Landing Gears

To CUSHION SHOCK

CPT's shock absorber principle combines pneumatic and hydraulic cushioning. It can control minute vibrations or tons of impact. It is the shock absorber for the largest aircraft landing gears (CPT is the world's biggest manufacturer of landing gears), and the same principles are often adapted to finger-sized units. May we discuss with you how to take the shock out of stopping or the motion out of vibration?



■ NATO

Airpower is West's Weakest Link In NATO Defense Against Reds

(McGraw-Hill World News)

Paris—High-ranking Allied officers have warned repeatedly during the last year that the greatest military weakness of the Western nations arrayed across the continent of Europe against the Communist East is in airpower. More than a volume of words, this brief warning points out the key role that airpower is expected to play in the defense of Western Europe.

Actually no responsible officer at Supreme Headquarters, Allied Powers in Europe (SHAPE) doubts that the Allied air forces could give an excellent account of themselves in any scrap with the Russians. The chances are the Communists would take a sound licking.

▶**Good, But Not Enough**—But in this atomic world that is not good enough. Western strategy is based on achieving as nearly complete and absolute air superiority as possible. The West must be supreme in the air to protect Western cities from devastation and to afford its ground troops the cover and close support they certainly would need in order to hold back a massive Russian attack.

The nations of the North Atlantic Treaty Organization (NATO), of which SHAPE is the military headquarters, are steadily building an immensely powerful Allied air force in Europe. This force is still far short of the goal that has been set for it but it compares favorably with the force Russia could throw against it.

▶**What Reds Have**—Allied intelligence estimates that Russia and her satellites have an air fleet of some 20,000 planes.

Of this total only 8,000 to 10,000 could be used in an attack against the nations of Western Europe because of the limitations imposed by the number of available airfields and by Russian commitments in the Far East and elsewhere.

▶**What NATO Has**—NATO air forces now have a few more than 5,000 planes. This total will be increased 30% to about 6,500 planes by the end of this year.

These figures do not include U. S. strategic bombers in Britain and French Morocco, a substantial part of the British Royal Air Force, or eight squadrons of the French Air Force in France and North Africa which would be available in an emergency but have not been committed to NATO command.

The NATO air forces will be strengthened considerably this year, however, by the appearance of three new, high-performance interceptors. The French Dassault Mystere and the British Hawker Hunter and Supermarine Swift all will begin going into squadron service before the end of the year.

It is estimated that the NATO air forces will get a total of about 3,000 new planes during this year. About half of these new planes will be used to replace older equipment. The other half will go to make up the planned increase to 6,500 planes in the NATO command.

▶**This Also Counts**—But number of planes alone is a poor measure of the strength of an air force. Tactics, training and the intricate complex of ground services that support and direct the air force in action are at least equally important. And it is in this field of operational efficiency that the West could reasonably expect to hold the big advantage over a Communist enemy.

Allied officers here point out that the final box score of the Korean war shows the United Nations flyers shot down 13 or 14 enemy planes for every U.N. plane lost. At the same time, U.N. air forces dominated the sky over the battlefield so completely that it might be hard to find a U.N. foot soldier who ever saw an enemy plane.

Airmen believe this almost fabulous record is largely the result of the much greater operational efficiency of the U.N. air force. Experts concede that in the MiG-15 the Communists had a good plane. But they were weak in tactics, gunnery, training and ground operations.

▶**Three-Years' Progress**—A major part of the buildup of the military strength of NATO nations during the last three years has been directed toward the goal of assuring that the West will enjoy the same margin of operational efficiency in the air as U.N. forces did in Korea. Excellent progress already has been made in this highly complicated task.

When Gen. Eisenhower assumed command of SHAPE three years ago, there were only 15 airfields on the continent of Europe capable of handling jet planes and available for military use. Now NATO has more than 120 airfields, and 40 more are programmed or

"The Biggest Part of My Job is SERVICE...

The TMI organization specializes in precision tubing for precision customers who need and expect the best every foot of the way. And that precision starts right from scratch, right from the initial plan for the application of the right tubing for the specific job at hand.

With TMI engineers on your team, *you have a definite advantage* over the manufacturer who is satisfied with the use of "average" tubing. That advantage starts with the designer and the engineer in your plant working with TMI specialists. It stops with nothing short of improved products . . . with less machining, less hand-fitting, less rejects at the inspection table.

Management sees the results of TMI teamwork on their profit sheet . . . and in the reputation of their product working for their customers.

"Next Time Specify TMI".

The Mark of Quality TMI

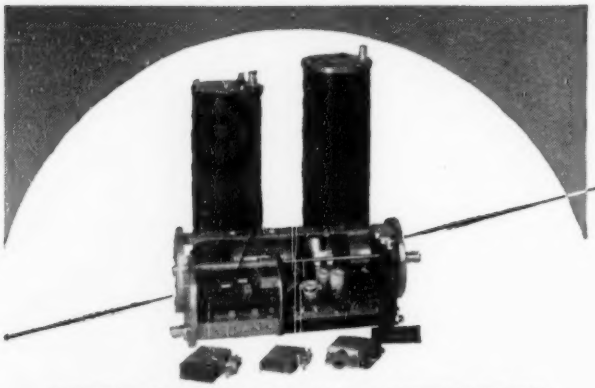
STAINLESS STEEL AND ALLOYS!
CLOSE TOLERANCES TO .0005"!
DEPENDABLE ENGINEERING GUIDANCE!
DELIVERY WHEN PROMISED!

You'll like to do business with

TUBE METHODS INC.

METALLURGISTS • ENGINEERS • MANUFACTURERS

BRIDGEPORT (Montgomery County), PA.

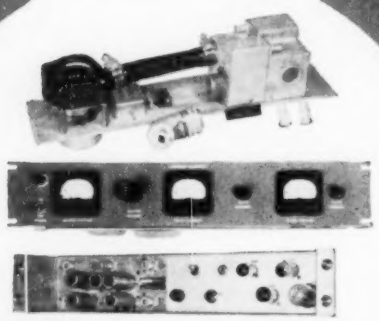


MODEL TK-M4/DC-M4 PW/FM AIRBORNE SET

Uses a 30 RPS commutator to sample 28 data sources in the 0 to +5 volt range. 4 to 5 watt crystal-controlled RF transmitter is frequency modulated. Equipment is sealed and pressurized for high altitude operation, and withstands ambient temperatures from −40°F to +140°F, 100g shock, and 12g vibration. Transmitting equipment is also available with other sampling rates and numbers of channels and in different packages for separate applications. Bulletin FBA-1.

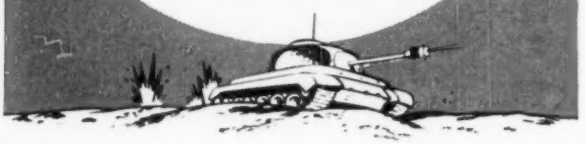
M SERIES PW GROUND STATION

Separates and reduces all data channels in real time. Operates on signals from standard airborne set, from FM/FM sub-carrier, or from magnetic tape recorder. Bulletin M-4



MODELS APA-1 RF PREAMPLIFIER AND AMC-1 MULTICOUPLER

Increase receiving gain and reduce noise figure for longer range RF link operation without increasing transmitter power. Permit connection of up to 4 receivers, tuned to different frequencies, to the same antenna. Bulletin APA-1.



ASCOP

Now Available!

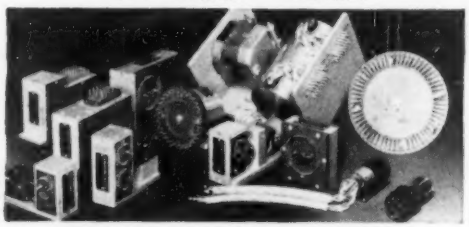
Complete Time Division Multiplex Data Systems

Standardized equipment is now available for complete systems for multichannel data transmission over a single radio link or recording on a single magnetic tape track, using time-division multiplexing and pulse width coding.

ASCOP systems engineers can now choose from a complete line of units for sampling, coding, transmitting, receiving, monitoring, separating, reducing, and recording to assemble systems to meet your data transmission or recording problems.

Pulse width data systems provide, through time division multiplexing, a large number of identical data channels of moderate frequency response. The handling of information in the form of time rather than amplitude allows accurate operation independent of the characteristics of the transmitting or recording medium. Utilization of zero and sensitivity reference channels affords continuous automatic system calibration and avoids the need for frequent manual adjustment.

A typical standard ASCOP PW system handles 26 separate data channels with 5 CPS response per channel with overall system accuracy, from original data source to final reduced output record, of better than 1%. Real time output of each channel is available as a meter reading and as continuous record from a direct-writing recorder.



ROTARY SAMPLING SWITCHES

Over 40 models, single and multi-pole, with up to 180 contacts per pole and speeds up to 100 RPS. For all applications requiring high quality switching of low level signals. Bulletin 521-R.

ASCOP

WE PROVIDE THE LEVER - YOU MOVE THE WORLD

Your inquiries are invited. Phone, wire or write to the nearest office, advising us of your requirements

Applied Science Corp. of Princeton

P.O. Box 44 Princeton, N. J. • Plainsboro 3-4141

1641 S. LaCienega Boulevard, Los Angeles 35, Calif. Crestview 1-8870

See Us at the I.R.E. Show • 206-208 Instruments Ave.

are being built at the present time.

Communications, too, have been vastly improved. Thousands of miles of landlines for exclusively military use have been laid, and a radio net with the most modern equipment has been put into operation. In addition, good progress has been made in standardizing communications procedures and training in all NATO nations.

To date NATO has spent about $1 billion on what is called "infrastructure"—airfields, communications facilities, barracks, etc. Another $500 million will be spent by the end of 1956. The lion's share of these funds has been earmarked for air force facilities with airfields as the largest single item.

▶**Fuel Facilities**—This year NATO will spend $252 million on infrastructure, about half of it to complete underground fuel-storage facilities at NATO airfields and to build 3,750 miles of pipelines to carry jet fuel from ports on the Atlantic and Mediterranean to the network of airfields in northern France.

One of these new NATO pipelines will run from Marseilles up the Rhone valley. The other will begin at Le Havre and run east. They will supplement a third pipeline to be built exclusively with U.S. funds, which will start at St. Nazaire and terminate at Metz.

These pipelines will be completed sometime next year. They will be connected to underground storage depots at airfields and at strategically located "fuel farms" which can serve several airfields. Fuel supply today is probably the most serious weakness of the NATO air forces.

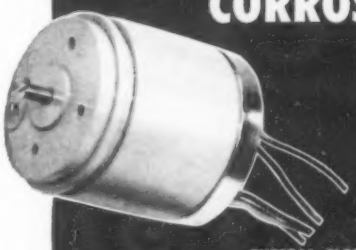
▶**All-Weather Fighters**—Another of NATO's major air problems, however, will not be so easily or quickly solved. This is the lack of all-weather fighters in NATO air forces. Airmen regard this as a serious weakness, but hold out little hope it can be corrected soon.

Allied officers here doubt that any USAF units equipped with F-94s, or other all-weather fighters, will be sent to Europe—at least for several months. The operation of all-weather fighter squadrons will require months of special training in the air forces of most NATO nations before such squadrons could go into service, even were the planes likely to be available soon.

▶**Bomber Punch**—The air forces under NATO command include no long-range bombers and only a few light bombers like the British Canberra. The big offensive punch available to the West in an emergency is the American B-47, units of which are operating from bases in Britain and Morocco.

Although they are not under NATO command, these B-47s are a major element in the West's growing airpower.

Eclipse-Pioneer



CORROSION-RESISTANT AUTOSYN* SYNCHROS

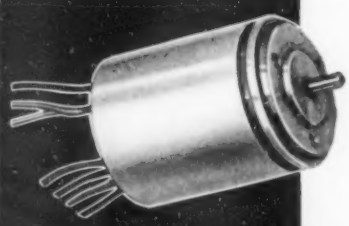
(AY-200 SERIES)

TYPICAL ELECTRICAL CHARACTERISTICS

	Type Number	Input Voltage Nominal Excitation	Input Current Milliamperes	Input Power Watts	Input Impedance Ohms	Stator Output Voltages Line to Line	Rotor Resistance (DC) Ohms	Stator Resistance (DC) Ohms	Maximum Error Spread Minutes
Transmitters	AY201S-26	26V, 400~, 1 ph.	125	0.6	40+j230	11.8	12	8.8	18
Control Transformers	AY201S-25	From Trans. Autosyn	Dependent Upon Circuit Design				40	10.2	20
Differentials	AY231S-25	From Trans. Autosyn	Dependent Upon Circuit Design				14	10.2	30
Resolvers	AY221S-26	26V, 400~, 1 ph.	70	0.4	108+j440	11.8	60	11.4	24

PYGMY AUTOSYN SYNCHROS

(AY-500 SERIES)



TYPICAL ELECTRICAL CHARACTERISTICS

	Type Number	Input Voltage Nominal Excitation	Input Current Milliamperes	Input Power Watts	Input Impedance Ohms	Stator Output Voltages Line to Line	Rotor Resistance (DC) Ohms	Stator Resistance (DC) Ohms	Maximum Error Spread Minutes
Transmitters	AY503-4	26V, 400~, 1 ph.	220	2.5	45+j100	11.8	23.0	11.0	24
Receivers	AY503-2	26V, 400~, 1 ph.	220	2.5	45+j100	11.8	23.0	11.0	75
Control Transformers	AY503-2	From Trans. Autosyn	Dependent Upon Circuit Design				170.0	45.0	24
	AY503-5	From Trans. Autosyn	Dependent Upon Circuit Design				550.0	188.0	30
Differentials	AY533-3	From Trans. Autosyn	Dependent Upon Circuit Design				93.0	45.0	30
Resolvers	AY523-3	26V, 400~, 1 ph.	55	0.6	290+j490	11.5	210.0	42.0	30
	AY543-6	26V, 400~, 1 ph.	11	0.12	900+j2200	11.8	560.0	165.0	30

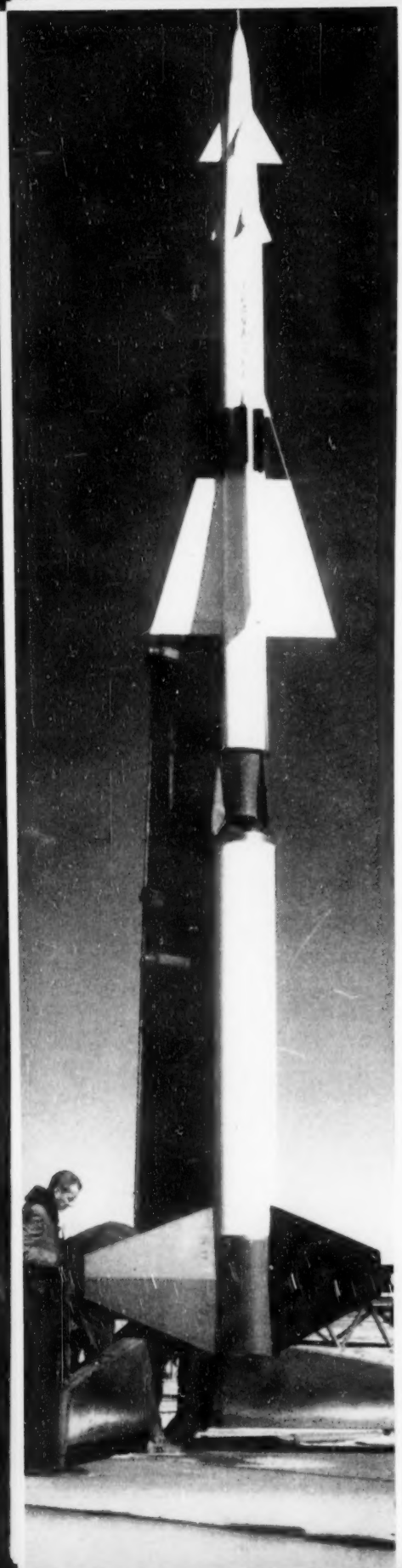
Available for all applications is the new, *corrosion-resistant* AY-200 Series of Eclipse-Pioneer Autosyn Synchros (1.431″ dia. x 1.631″ lg.). Where space and weight are prime considerations, Eclipse-Pioneer offers the AY-500 Pygmy Autosyn Synchro Series (0.937″ dia. x 1.278″ lg.) with corrosion-resistant models available in sample quantities. Whatever your synchro requirements may be, our long experience, modern facilities and advanced production techniques can work to your advantage. For full details, write Department H.

*Registered trade-mark Bendix Aviation Corporation

THE NAME Bendix AVIATION CORPORATION MEANS THE

ECLIPSE-PIONEER, Division of TETERBORO, N. J.

Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.



Missile Program Depends On What U. S. Can Afford

Re-evaluation of tomorrow's weapons shows that future costs of all present projects may be too great a drain on national economy.

By David A. Anderton

The entire future of guided missiles in this country hangs on a slender green chain of dollar bills.

The plain facts are that we cannot afford to produce all the missiles now in several stages of development throughout the country. We cannot afford to keep all the research and development establishments going to back up all the projects. We cannot afford to keep firing a myriad of special-purpose test vehicles. We couldn't possibly afford an all-out offensive with the new weapons.

In short, the missile has grown in 10 years from a cheap, expendable item made of low-grade steel to a complex metallic organism which now compares in cost to a conventional airplane designed to do roughly the same job.

▶ **Old Problem, New Concern**—This isn't a brand-new problem. Ever since there has been a missile program in this country, people close to it have worried as they watched costs skyrocket. They have always believed that no real results could ever be obtained from a missile program which disregarded the question of ultimate costs.

But no official action was taken on any overall basis. It remained for the "new look" in defense policy to stimulate a close scrutiny of the dollar value of the missile program.

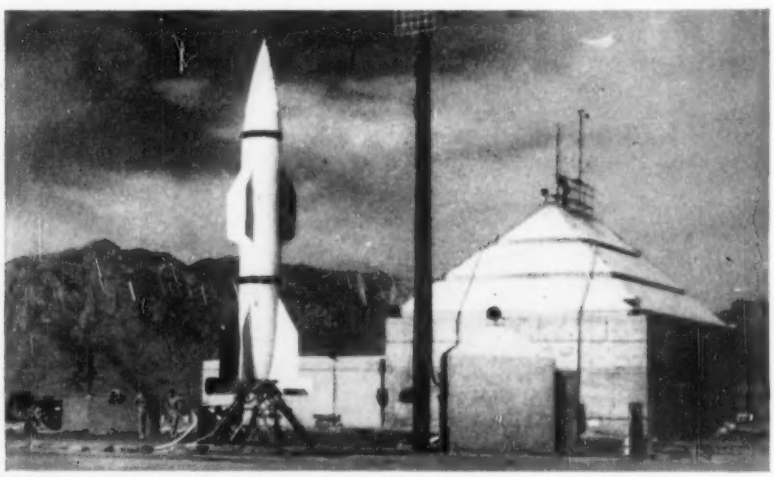
Under the leadership of Trevor Gardner, special assistant for research and development in the USAF, a committee examined the expansive missile industry. They toured plants, talked to engineers and managers, heard presentations. Then they returned and wrote an interim report, now in the hands of Donald Quarles, assistant secretary of the Air Force for research and development.

That report is dynamite. It spells out life or death for every one of the half-hundred missile or component projects currently under way in this country. It separates the sheep from the goats.

It contains the answers to the single simple question which determines future missile policy of the United States:

• **What kind of missiles can we afford?**

▶ **Long Overdue**—This kind of approach



EARLY YIELD of postwar projects is Nike (left) and Hermes A-1 test vehicle.

B-61A MATADOR ROARS OFF zero-length launcher and into climb to cruise altitude. Speed is subsonic until final supersonic dive.

to the problem is long overdue, according to those in the missile business. In the postwar rush to get going on development and production of the awesome weapons of the future, there was little concern with ultimate costs. There was, in fact, little concern with any long-range planning.

Then K. T. Keller, chairman of the board of Chrysler Motors, was called in to handle the transition from research and development into production. His main mission was to get promising projects firmed up in tangible hardware.

The industry was "Kellerized"; immediate production was ordered for three missiles. Later, others joined the select trio. One of the last arrivals on Keller's list was Redstone, an Army Ordnance missile which is to be produced in quantity under a multi-million dollar contract, by Chrysler.

Keller has since moved out, as quietly as he moved in. The fact that we have production quantities of some missiles today, and will have some more tomorrow, is due in great measure to his brute-force approach.

▶ **Gardner Group**—The first job of the Gardner committee was to find duplication in the Air Force guided missile program. That duty was later extended to cover the projects being carried on by all the services.

Still later, Gardner's committee was asked to consider overall economizing in the entire missile program. They were to name the most promising projects in research, development and production.

Details of the Gardner report are highly classified, as are most phases of the missile program. Some indication of the magnitude of the Gardner committee's work can be gotten from the accompanying tabulation of missile projects.

In more detail than the table permits, these following paragraphs describe some of the current missile programs.

Air-to-Air

Original concept of air-to-air guided and propelled missiles probably rates back to two tactical tricks used by Luftwaffe fighter aircraft during World War II. Kept at a respectful distance by the overlapping defensive firepower of the bomber box, the fighter planes used unconventional approaches.

Small unguided solid-propellant folding-fin rockets known as the R4M were fired in salvo from a line-abreast fighter formation either ahead or to one side of the bomber box.

Light fragmentation bombs with time-delay fuses were dropped into the bomber box from above.

Both tactics had limited success. The fighters were still too far away to achieve the necessary accuracy. So air-to-air weapons were rushed into development, and at the end of the war, there were several of these new type weapons that were undergoing tests at the Luftwaffe's experimental fields.

▶ **Postwar Missile**—In the United States, the first postwar work on AAMs was typified by Ryan Aeronautical's Firebird. This slim missile set the fashionable lines for most of those that came after. Measuring about 10 ft. long and 6 in. in diameter, Firebird achieved limited success. The program was completed, but the bird never went into production.

In general, this class of missile is intended to replace fighter or bomber armament. Related to the unguided aircraft rockets, AAMs are in a size and weight class with Firebird. Most of them use solid-propellant rocket motors and are unboosted. Speed at burnout of the rocket charge is about Mach 3.

Current missile projects include:

• **Hughes F-98 Falcon, for the USAF.** Now in production at Hughes' Tucson, Ariz., plant, Falcon is to be paired with the Convair F-102 interceptor as armament for the supersonic fighter. A typical installation of the Falcon would pair the missiles in underwing racks. Propulsion is provided by a solid-propellant sustainer rocket; top speed is Mach 3.

• **Sperry Sparrow, for Navy BuAer.** Actually there are several Sparrows, made by combinations of companies including Sperry Gyroscope, Raytheon Manufacturing Co., and Douglas Aircraft. Early versions have been built by Douglas, but main production is to come from Sperry's new plant at Bristol, Tenn. Sparrow used delta wings and tail in an early version, and weighed about 300 lb. Power comes from a solid-propellant sustainer, and burnout speed is about Mach 3.0. Range is about five miles.

• **Martin Oriole, for Navy BuAer.** Reports identify this missile as a ramjet-powered, 1,500-lb. bird, carrying a distance of 20 mi. at Mach 3. This is out of the usual size class of AAMs, but may represent a different approach to the problem of aircraft destruction. Size and range indicate that Oriole is intended to arm long-range interceptor aircraft, to knock enemy bombers, not fighters, out of the sky.

• **Bell Meteor, for Navy BuOrd.** Meteor originated under a contract with Massachusetts Institute of Technology for a missile; MIT was to call in other companies for development and production of laboratory items. In with MIT were Federal Telecommunications Lab, where the guidance system was de-

veloped, and Bell Aircraft Corp., where Meteor was to be built. The missile weighed about 500 lb., was propelled by a liquid-rocket engine and carried a 25-lb. warhead at a speed of Mach 3.0. The project was reported canceled last summer.

Air-to-Surface

The only purpose of an air-to-surface missile is to give greater immunity to the attacking bomber by increasing the distance between the target and the point where the bomb load must be dropped.

Air Force developments such as Azon, Razon and Tarzon—which were free-falling bombs that could be steered by command signals from the drop aircraft—are not considered in the category of air-to-surface missiles. To qualify, an ASM has to have propulsion, guidance and lifting surfaces. Then it becomes a small pilotless bomber, consigned to one-way missions.

In addition to the Bell Rascal, Douglas Aircraft Co. has announced that it is working actively on an ASM; no further details have been released.

• **Bell B-63 Rascal, for USAF.** Rascal is a small, rocket-propelled aircraft that resembles Bell's X-1 research series. Launching gear similar to that used to drop the X-1 releases the B-63 from the mother ship about 100 mi. from target. After the drop, initial guidance is done by a preset programming device in the missile; midcourse and terminal guidance is by radar from the mother ship. Maximum speed exceeds Mach 1.5 (AVIATION WEEK Jan. 18, p. 18).

Air-to-Underwater

This category of missiles includes types designed solely to chase submarines. Launched from an aircraft, AUMs plunge toward the water and dive beneath the surface, homing on a submarine at high speed. Useless wings or other appendages may be sheared off on contact with the water, leaving not much more than a sophisticated torpedo to continue the hunt.

This approach was tried by the Germans during the war; their naval ordnance experts came up with a revised torpedo shape—divorced from the hemispherical nose so favored by U. S. naval

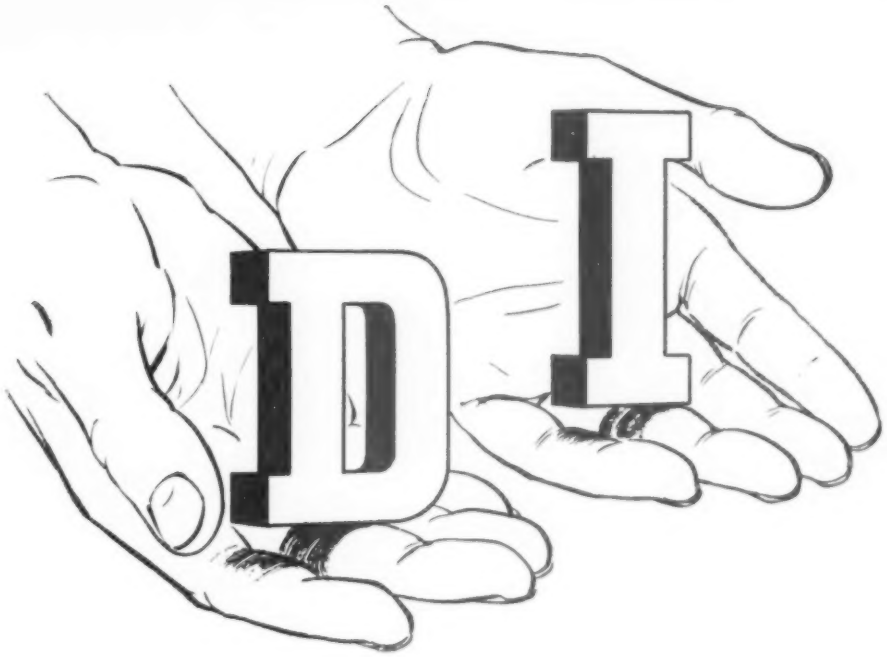
U.S. Guided Missiles

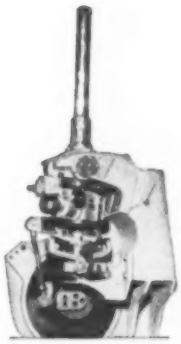
Category	Designation and name	Manufacturer	Service	Powerplant mfr. and type	Max. range, mi.	Overall length, ft.	Body dia. ft	Takeoff weight, lb.	Remarks
Air-to-Air (AAM)	F-98 Falcon	Hughes	USAF	s.p. rocket					Mach 3 speed
	Sparrow	Douglas	BuAer	s.p. rocket	5			300	Mach 3 speed; to be built in several versions
	Oriole	Martin	BuAer	Ramjet	20			1,500	Mach 3 speed
	Meteor	Bell	BuOrd	l.p. rocket				500	Mach 3 speed; cancelled
Air-to-Surface (ASM)	B-63 Rascal	Bell	USAF	l.p. rocket	100				Similar to Bell X-1; Mach 1.5 speed
		Douglas							
Air-to-Underwater (AUM)	Petrel	Fairchild	BuOrd	Fairchild J44 turbojet					For training only
Surface to Air (SAM)	Lark	Fairchild	BuAer	Reaction Motors l.p. rocket		14	1.5		Out of production
	Terrier	Convair	BuOrd	Aerojet s.p. rocket	10			3,000	For shipboard service; Mach 2 speed
	Nike	Douglas	ArmyOrd	Aerojet l.p. rocket.	20	20	1.0		Canard, delta surfaces; in service with Army
	F-99 Bomarc	Boeing	USAF	Ramjet rocket				5,000	Winged & finned body; Mach 2.5 speed
	Loki	Bendix	ArmyOrd	Grand Central					Finned body
	MX1868	Oerlikon		s.p. rocket l.p. rocket		16	1.3		Swiss development; under test in U.S.
Surface-to-Surface (SSM)	B-61 Matador	Martin	USAF	Allison J33 turbojet	500	30	4.5	12,000	In service with USAF; subsonic
	Corporal	Firestone	ArmyOrd	Aerojet l.p. rocket		40	2.5	12,000	Tactical missile
	Regulus	Vought	BuAer	Allison J33 turbojet		30	4.5		Sweptback, tailless
	Honest John	Douglas	ArmyOrd						Artillery rocket
	B-62 Snark	Northrop	USAF	Allison		32	4		Sweptback, tailless; subsonic speed
	Navaho	North American	USAF						Long range
	Redstone	Chrysler	ArmyOrd			60	5		Developed by German scientists in U.S.
	Lacrosse		Marines	Reciprocating engine	8				Close-support use
	Hermes A-3	General Electric	ArmyOrd	GE l.p. rocket					Short-range
	Rigel	Grumman	BuAer	Marquardt ramjet					Project inactive
Test or Research	Aerobee	Aerojet	USAF; Navy	Aerojet l.p. rocket		20	1.3	1,690	Finned body layout
	Bumper	Douglas	ArmyOrd	l.p. rocket					V-2 plus WAC Corporal two-stage rocket
	Hermes A-1	General Electric	ArmyOrd	GE l.p. rocket		25	3		Based on German C2/E2 Wasserfall (SAM)
	X-7	Lockheed	USAF	Marquardt and Wright ramjets					Engine test vehicle
	X-10	North American	USAF						Test vehicle for Navaho; first flight in February
	Viking	Martin	NRL	Reaction Motors l.p. rocket		42	4		Holds altitude record of 136 miles

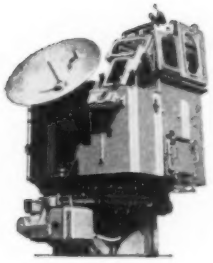
NOTE: This list includes contemporary missiles and test vehicles which are either experimental, or in production or in service. No attempt has been made to list the many useful but outdated test vehicles such as the North American Nativ or Cobra or early operational missiles, like the Navy's Bat.

Abbreviations:

ArmyOrd — U. S. Army Ordnance
BuAer — U. S. Navy Bureau of Aeronautics
BuOrd — U. S. Navy Bureau of Ordnance
NRL — Naval Research Laboratory
USAF — United States Air Force
l.p. — liquid propellant
s.p. — solid propellant







Skilled hands

Skilled hands—1500 pairs of them are busy every day at Daystrom Instrument—performing research, development and manufacturing tasks on a wide variety of precision electrical and mechanical instruments. Daystrom specialists are prepared and ready to analyze your requirements and translate them from drawing board to finished products—all within our own modern plant of 350,000 square feet. All development and manufacturing are achieved through advanced techniques. We are proud of the fire control and radar equipment we produce for our Army and Navy. Daystrom products include computors, gyros, servo amplifiers, electronic chassis, sheet metal cabinets, test equipment, gear assemblies, servo controls, radio and precision potentiometers.

Write today for our facilities report.

★ RESEARCH
★ DEVELOPMENT
★ DESIGN
★ PRODUCTION

DAYSTROM INSTRUMENT

DIVISION OF DAYSTROM, INCORPORATED

ARCHBALD, PENNA.

Affiliates:
American Type Founders, Inc., Elizabeth, N.J.; Daystrom Furniture Div., Olean, N.Y.; Daystrom Electric Corp., Poughkeepsie, N.Y.

RELIABLE
AND STABLE
PERFORMANCE
•
servo components,
instruments,
synchros

ae

Let us quote on your detailed requirements.

American Electronic Mfg., Inc.

9583 W. JEFFERSON BLVD., CULVER CITY, CALIF.
TELEPHONE: TExas 0-5581 VEmont 8-6402

architects—combined with wings and tail sections which balanced and controlled the missile during its air drop. On impact, wings and tail sheared off, and the homing torpedo sped on alone.

There has been no official mention of any U. S. missile in this category, but at least one is known to exist:

• **Fairchild Petrel, for Navy BuOrd.** Powered by the lightweight, expendable Fairchild J44 turbojet, Petrel is one of a series of similar missiles named after diving birds. Design of the series originated with the National Bureau of Standards. Naval units have trained with Petrel, and production at Fairchild's Guided Missiles Division, Wyandanch, Long Island, has matched the need of training duties.

Surface-to-Air

Second in importance only to the long-range surface-to-surface missiles, the anti-aircraft weapons in this category range from the simplicity of Loki, an unguided solid-propellant rocket, to the F-99 Bomarc, a complete air defense system of which the pilotless interceptor is only a part.

▶ **Active and Passive**—Guidance systems also run the gamut of sophistication. At one end is the "passive" type, characterized by extensive ground radars which do the work and tell the missile to go right, left, up or down. The beam-rider system is one example of this; in it, the bird rides the center of a radar beam, much as a twig drifts along the center of a stream.

At the other end of the scale is an "active" guidance system, which most engineers feel is too large to get into a missile. It would be a completely self-contained system, which could locate the target, and home on it without any reference to ground-collected data. This is the ultimate.

There is a middle ground, called "semi-active," a guidance scheme used in the Fairchild Lark, as one example. Details have not been released, but one kind of semi-active system would call for firing the birds along a predicted flight path, laid out in the sky by data from a ground radar tracking the target. When the missile neared the theoretical intercept point, small internal homing radar would take over and guide the missile to the target.

These are the SAM projects of current interest:

• **Fairchild Lark, for Navy BuAer.** Rocket-propelled and featuring a semi-active guidance system considered by many to be ahead of its time, the Lark now is out of production. There are still a few rounds in the hands of training units. Lark used rectangular wings and tail surfaces rotated so that they were 45 deg. out-of-plane to each other. Powerplant was a Reaction Motors, Inc., liquid rocket engine. Speed was subsonic, limited to Mach 0.9. Complete analysis of the Lark was carried in AVIATION WEEK May 22, 1950, p. 12.

• **Convair Terrier, for Navy BuOrd.** Intended as a shipboard defense weapon, Terrier is one of a family developed under a Section T contract between Navy and the Applied Physics Laboratory of Johns Hopkins University. The contract, under the code name of Bumblebee, has produced a large number of test vehicles and at least three missiles—Terrier, Talos and Triton.

Terrier went into production at Convair's Pomona plant early in June 1951. It is a canard layout, with trapezoidal wings and control surfaces. Sustainer rocket motor is a solid-propellant Aerojet unit. Weight is about 3,000 lb. with solid-propellant booster attached. Range is on the order of 10 miles; top speed is about Mach 2.

• **Douglas Nike, for Army Ordnance.** Originally designed to cope with bombers in the class of the Boeing B-29, Nike requirements never were updated to keep pace with technological developments. As a result, the missile is now ready for service in production quantities, but could not shoot down most of the enemy's bomber fleet. Chief value of Nike is as propaganda for the Army and to keep congressmen feeling safe, say some observers.

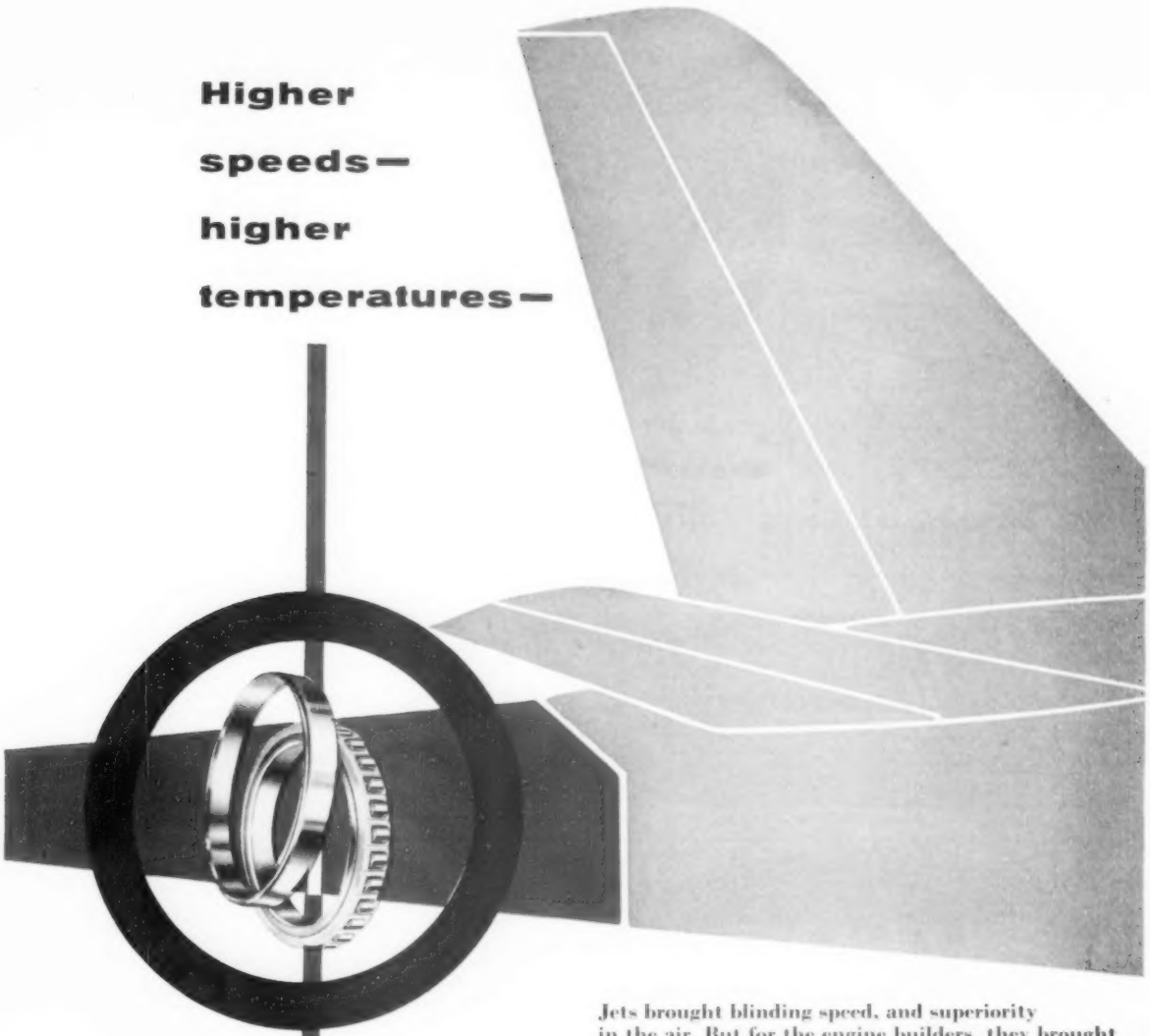
With slant range of 18 mi. Nike could only reach out to strike aircraft inferior to the Boeing B-47. Against a highspeed bomber, its performance would be doubtful. Nike, propelled by an Aerojet liquid-propellant rocket engine and needing a solid-fuel booster for launching, is built around a delta canard geometry. Guidance is beam-rider. Cooperating firms are Douglas (airframe); Western Electric and Bell Telephone (AVIATION WEEK Dec. 28, 1953, p. 13).

• **Boeing F-99 Bomarc, for USAF.** Bomarc is a complete air-defense system, involving much more than the development of the pilotless interceptor bearing the F-99 designation. An outgrowth of the GAPA program which was cut out from under Boeing in 1948, Bomarc has drawn heavily on the earlier ramjet and airframe development.

From the only picture released, Bomarc appears to have both rocket and ramjet powerplant. Layout is conventional, using a single trapezoidal midwing and trapezoidal tail surfaces. Weight is about 5,000 lb. and top speed is about Mach 2.5.

Judging by the layout, Bomarc banks in maneuvers; this concept is unique among missiles, which generally use two sets of lifting surface at right angles and

Higher speeds— higher temperatures—



HYATT BEARINGS!

Jets brought blinding speed, and superiority in the air. But for the engine builders, they brought problems. With higher speeds came higher operating temperatures, and engine parts, especially bearings, had to be designed to withstand destructive heat. So designers turned to Hyatt. With unexcelled research and development facilities, modern production equipment, and years of experience, Hyatt was a logical choice. Hyatt know-how assured highest quality in mass production, and since 1944 Hyatt has been a major supplier of jet bearings. When design requirements are beyond the capabilities of ordinary bearings, always call on Hyatt.

Partial list of aircraft equipped with turbo-prop and turbo-jet engines using Hyatt Bearings:

Bell X-5 Research Monoplane
Boeing XB-47C Air Force Medium Bomber
Consolidated—Vultee Model 7002 (XF-92A)
Consolidated—Vultee Turboliner
Douglas XA2D-1 "Skyshark" Navy Attack Bomber
Grumman F9F "Panther" Navy Fighter Plane
Lockheed F-80C "Shooting Star" Fighter Plane
Lockheed F-94A & B Air Force Fighter Plane
Lockheed TO-1 U.S. Navy Version of the F-80G For Use as Jet Trainer
Martin P4M-1 Long Range Navy Patrol Bomber
Martin B-57A U.S. Air Force Version of the English Electric Canberra Medium Bomber
North American AJ-1 "Savage" Navy Carrier Attack and Search Airplane
Northrop F-89A All Weather Fighter Plane
Northrop YRB-49A "Flying Wing" Heavy Bomber
Republic F84F "Thunderjet" Fighter Plane

HYATT

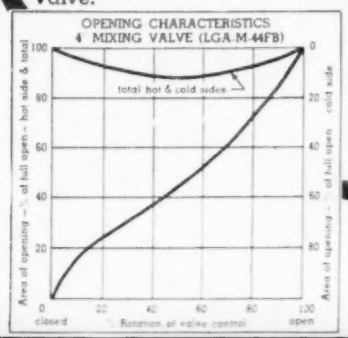
STRAIGHT ROLLER BARREL ROLLER TAPER ROLLER

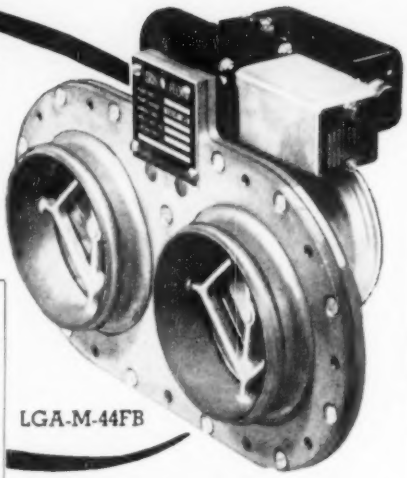
HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, N. J.

IRIS FLO

MIXING VALVE

Linear characteristics and low pressure drop! If these are requisites for your installation, specify the Lundy Iris Flo Valve.





LGA-M-44FB

Specialized actuation or air control problems? Full line of actuators, Aeromotors and Iris Flo Valves available for the job — Or we will design to your specifications.

Lundy LUNDY MANUFACTURING CORPORATION
36-08 33rd STREET, LONG ISLAND CITY 6, N. Y.
Manufacturers of ACTUATORS AEROMOTORS IRIS-FLO VALVES
Western Offices: Los Angeles Tel. STate 4-4007

CEE BEE
CHEMICAL COMPANY, Inc.
EST 1931

We Know Our FUTURE
Because You Know Our PAST

Cee-Bee, with more aviation firsts than any other chemical company, now is first to offer a complete service department for integral fuel tank desealing, repairing and resealing, and removal of corrosion, oxidation and paint from exterior aircraft surfaces. Look to Cee-Bee for tomorrow's chemicals, procedures and service TODAY.

Write today for your copy of Cee-Bee production and maintenance bulletins.

First—Brightener—safely removing corrosion and oxidation.

First—Cold engine carbon remover compound. Prevents hard carbon deposits.

First—Mechanical recirculating spray system to remove sealants and clean integral fuel tanks—safety approved.

First—Successful paint and enamel remover and cleaner for jet engines.

First—Paint stripper spray on and wash off.

First—Chemical company to employ exclusively aircraft trained technicians to serve your cleaning and stripping problems.

CEE-BEE CHEMICAL CO., Inc.

9520 East Ceebee Drive
Downey, California

turn around one set or the other while the missile axes remain unmoved.

• **Bendix Loki, for Army Ordnance.** First developments on this project were based on the German WWII flak rocket Taifun, which was a simple, unguided rocket to be used in barrage fire. Layout is a simple finned body, and propulsion is a solid-propellant unit by Grand Central Aircraft Co.

• **Oerlikon MX 1868.** This anti-aircraft rocket was developed by the Swiss armament firm, and is reported to be under test in the United States. The missile has four cruciform wings mounted on a slender body at about the two-thirds point; no other surfaces are fitted for lift or control. A liquid-rocket engine powers the missile. Beam-rider guidance system was developed by Brown-Boveri, another Swiss firm. Range is reported to be about 12 mi.; speed is supersonic. First details of the missile were published in AVIATION WEEK Sept. 17, 1951, p. 18.

Surface-to-Surface

Surface-to-surface missiles offer the most serious competition to the entrenched weapons of each service: the Air Force strategic bomber, the Army artillery and the Navy aircraft carrier.

Under intense development by each service, SSMs have been designed for an extreme range of tactical and strategic uses. They will support Marine assault teams in close work on a beachhead or reach out over intercontinental distances to strike an enemy. They will smash troop concentrations or railroad yards under weather conditions which keep tactical aircraft on the ground. They will—but they won't just now.

► **Matador Squadrons**—To the Air Force goes the honor of activating the first guided missile squadrons. The 1st and the 69th Pilotless Bomb Squadrons, trained at Patrick AFB and the Air Force Missile Test Center, Cocoa, Fla., have been scheduled to go to Germany. Trained on B-61A Matadors, their service weapons will be a further refinement of Martin's missile, to be designated B-61B.

Close on Air Force heels comes the Army, with the announcement that two of its artillery missiles—Corporal and Honest John—will be used in field exercise Flash Burn scheduled for April and May.

► **New Approach**—There is one design trend which does not show in the examination of any lists of current SSMs. The ballistic missile, which does not fly through the atmosphere like a conventional aircraft but follows the parabolic trajectory of artillery shells, is coming in again for close scrutiny by planners

and designers. The idea was passed over in favor of "flying" missiles because of the difficulties of terminal guidance and skin heating in ballistic missiles.

But gradually there has come the realization that only a ballistic missile is free from interception; even the V-2 of ten years ago could not be stopped by any technique known today except by knocking out the firing teams and sites. New approaches to cooling, new materials and new ideas have lessened the danger of premature bursts from overheated warheads.

There are more radical ideas to come in this type of missile, and its importance will grow greatly during the next few years.

Meantime, these are the tactical and strategic missiles in our arsenal:

• **Martin B-61 Matador, for USAF.** Closely resembling a contemporary airplane without provision for a pilot, Matador has been a production item at Martin since December 1951 (AVIATION WEEK Oct. 5, 1953, p. 28). Thrust off by Rato from a zero-length launcher, Matador climbs to cruise-out altitude and speed of Mach 0.9, and dives supersonically into the target.

• **Firestone Corporal, for Army Ordnance.** Corporal design originated as one of a series of rocket-propelled test vehicles named after ranks in the Army and the Women's Army Corps (hence the WAC Corporal, the Private, Sergeant and Corporal). Powerplant is an Aerojet liquid-propellant rocket engine. The missile resembles the V-2, is about the same height (40 ft.) but only about 2.5 ft. in diameter. It is being built by Firestone Tire and Rubber for use by the Army Field Forces.

Many test and training rounds have been fired, and the first use of the missile in simulated support of ground troops is scheduled for the upcoming Flash Burn exercise.

• **Chance Vought Regulus, for Navy BuAer.** Comparable to USAF's Matador in size and performance, the Regulus differs in aerodynamic layout. It is a tailless bird, with highly swept wings and a nose inlet feeding its Allison J33 turbojet. Vought got a production contract last year for a quantity reported to be less than 200 birds.

A unique feature is that Regulus is returnable and uses wheeled gear to make conventional landings on conventional runways, as opposed to the skid landings of some AF missiles at Patrick AFB. Useful life of Regulus and its value as a test vehicle have been greatly increased through returnability. Length is about 30 ft., diameter about 4.5 ft., and weight probably around the 12,000-lb. level of Matador.

• **Douglas Honest John, for Army Ord.** This missile is called an artillery rocket by the Army, and probably is not a very complex beast. First official mention came in connection with announcement of Flash Burn.

• **Northrop B-62 Snark, for USAF.** For seven years, Snark (named from Lewis Carroll's nonsense poem in Alice in Wonderland) has been kept deep in the security thicket. It is a sweptback, tailless configuration powered by an Allison turbojet.

Snark capability may have been roughed out by John K. Northrop in testimony prepared for the President's Air Policy Commission in 1947: ". . . Know-how is presently available for the design of a 600-mph. missile with a range of 4,000 mi. or better. . ."

• **North American Navaho, for USAF.** This program also is shrouded in a thick security blanket. But North American's huge rocket motor development installation at Santa Susana is a tipoff that Navaho depends on rocket propulsion for part of its flight. NAA work on air-bearing gyros provides the clue to long-range capability of the missile; air-bearing gyros are practically frictionless, and have very small drift errors over a long time, thus aiding pinpoint navigation.

There is also a Navaho test vehicle, reported to be designated X-10, which made its first flight last month at the Air Force Flight Test Center, Edwards AFB, Calif.

• **Chrysler Redstone, for Army Ordnance.** Chrysler's part in this program calls for research, development and

Three "pictures" tell the tale . . . Simply, Accurately!

KEYSTONE
3-POSITION INDICATOR

Requires but a Small Space —Gives a "BIG PICTURE" on Operating Conditions

The landing gear markings shown above are but *one* of *eleven* different instrument applications. Tells the story "at a glance" on *flap positions, oil pressure or temperature, fuel supply* and other operating conditions. Economical, easy-to-install in both small and large planes.

Actual Size

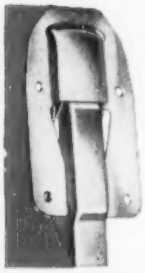
High Quality Construction

- Impervious to dust, moisture, gases
- Hermetically sealed brass case
- Filled with inert gas
- Optically clear glass window
- Corrosion resistant finish

RIVERSIDE

For additional information, write to

KEYSTONE WATCH CASE DIVISION
RIVERSIDE METAL CO.
Riverside, New Jersey



FRONT VIEW

SIDE VIEW

Hartwell Flush Latches

BACK VIEW

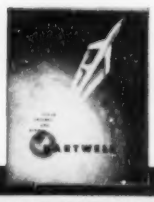
AVAILABLE FOR OVER

300 COMBINATIONS OF DOOR & FRAME THICKNESSES

HARTWELL Trigger-action Flush Latches are produced in over 300 standard combinations of bolt and trigger offsets. We can supply a latch for any door to be latched in any frame within thickness ranges common to standard sheet metal practice.

No altering of panels and frames is necessary when HARTWELL Flush Latches are installed. Offsets of bolt and trigger are stamped on each part for rapid and accurate selection of the correct latch for each installation.

All HARTWELL Flush Latches and Hinges are the result of nearly two decades of continuous specialized design and manufacture.



New 1954 Catalog illustrates and gives full details of complete line.

Mail Coupon

HARTWELL AVIATION SUPPLY COMPANY
9035 Venice Blvd., Los Angeles 34, Calif.

Send Illustrated 1954 Catalog.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

■ MISSILES

production of the Redstone missile, originally designed by a group of ex-German scientists now in the U. S. at the Army's Redstone Arsenal, Huntsville, Ala. Part of Redstone's technical backlog was information on long-range ramjet and rocket missile design turned over to the group by General Electric's Project Hermes. That experience may have found application in the Redstone missile.

• **Lacrosse, for the Marines.** This short-range missile is intended for close support of Marine assault teams. It is powered by a reciprocating engine, has a range of about eight miles.

• **General Electric Hermes A-3, for Army Ordnance.** This designation applies to one of a series of Hermes missiles under development by GE engineers for Ordnance. Basic mission of the series is tactical. The Hermes project includes considerable basic development work in propulsion and guidance, as well as specific applications to missiles (AVIATION WEEK Mar. 8, p. 26).

• **Grumman Rigel, for Navy BuAer.** Another well-kept secret, Rigel like Vought's Regulus, named after a first-magnitude star was a long-range missile design incorporating an integral Marquardt ramjet. Grumman says it now has no missile contracts, so it is presumed that Rigel is either inactive or was canceled.

• **Convair Atlas, for USAF.** This is a very long-range intercontinental ballistic missile drawing on Convair study and test program with the MX-774 project.

Test and Research

The test and research missiles are the workhorses. Unglamorous, even unappealing to the eye, the lowly test vehicle is the solid foundation on which many a missile program has built.

There have been wooden vehicles, boosted by a solid-propellant rocket to check rough flight characteristics during launching. Some have been small-scale models of the big thing, as in the Hermes B tests. Some have been converted into missiles—the Corporal is one example.

Crammed with instrumentation and with warheads replaced by avionic gear, early production missiles have been pressed into service as test birds. There is an extreme view, held by many missile engineers, who say that every flight is a test flight.

► **Big and Small**—Any table of research missiles is necessarily incomplete. To a rocket engineer, a 5-in. aircraft rocket with a test probe and five channels of telemetered information is a test vehicle as much as is the 42-ft. aristocrat of test birds, the Martin Viking.

You simply can't list the hundreds of test vehicles under the Bumblebee program, which included Cobra (for "cobbled-up ramjet," said one engineer) and one which was almost named Essobee, after the maker of the fuel it burned and as an indication of its behavior. Boeing's GAPA program expended many test rounds; NACA has conducted research with rocket-powered vehicles for several years. There was NATIV (for North American Test Instrumentation Vehicle) and MX-774, a ballistic test missile by Convair.

Most of these have been made obsolete by changes in program or new windtunnels or improved methods of calculation. They flourished in the early postwar missile period.

Today these are the test and research missiles of interest:

• **Aerojet Aerobee, for USAF, Navy and Army.** Aerobee has been used since 1947 for a variety of jobs mostly connected with upper-atmosphere research. It is 20 ft. long, 15 in. in diameter, weighs 1,690 lb. including the booster at takeoff. Aerojet developed the rocket and its engine, a liquid-propellant type (AVIATION WEEK Feb. 1, p. 30).

• **Douglas Bumper, for Army Ordnance.** Douglas built the modified nose of the V-2 rocket which served as the first stage of this two-stage high-altitude prober. Original design came from the Jet Propulsion Laboratory at CalTech, passed through the ex-Peenemuende scientists then at Ft. Bliss, Tex., and went to General Electric, where project responsibility was placed.

Bumper is a combined WAC Corporal and V-2; at burnout of the V-2, the WAC is fired and its velocity and altitude performance are added to those of the V-2. Bumper round No. 5 established a 250-mi. altitude record; successful Bumper rounds were the first two-stage liquid-propellant rockets ever fired (a four-stage solid- propellant missile, Rheinbote, had been built and fired by the Germans during the war).

• **General Electric Hermes A-1, for Army Ord.** The A-1 was a missile test vehicle for surface-to-surface missiles developed on the Hermes project, but rather peculiarly was built to the design of a German anti-aircraft missile, the C2-E2 Wasserfall. Two changes were made in the layout: Wasserfall's wings were clipped and the air rudders were of different shape. Internally everything was different. A few rounds were built and tested by GE.

• **Lockheed X-7, for USAF.** This is reported to be an engine test vehicle for Marquardt and Wright Aeronautical ramjet engines.

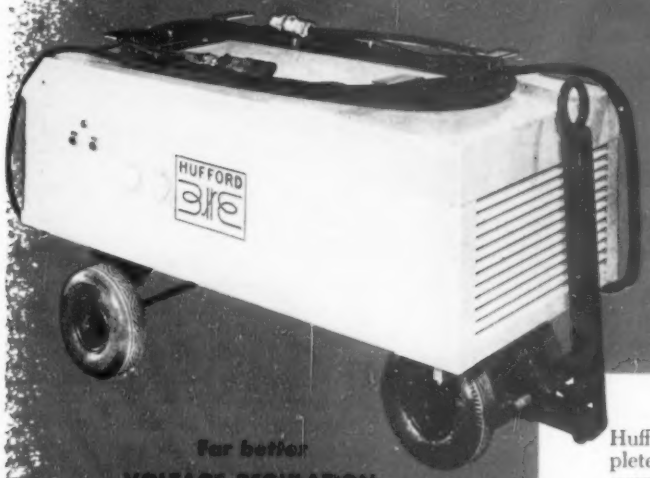
• **North American X-10, for USAF.** This is a test vehicle for the North American Navaho missiles probably intended for development of the guidance system.

• **Martin Viking, for NRL.** This Vik-

maintenance-free, heavy duty

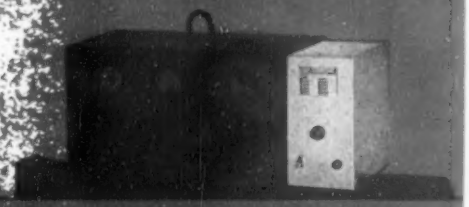
A.C. TO D.C. REGULATED

POWER SUPPLIES



- *for production line testing*
- *laboratory testing*
- *pre-flight check-out of electronic equipment*
- *engine starting*
- *anodizing, electro-plating, etc.*

for better
VOLTAGE REGULATION
from your present D.C. generator with
HUFFORD ROTA-MAG



This new Hufford development improves performance of all D.C. generators by providing superior voltage regulation up to the full generator capacity!

With suitable generators performance is equivalent in electrical characteristics to the most modern power supplies!

ROTA-MAG is complete, self-contained, ready to mount. It may be adjusted for any generator output voltage.

REGULATION: ±1% over full rated generated capacity.
RESPONSE: 0.2 second with application of full load.

Literature available!

Hufford Electronic Division announces a complete line of heavy-duty, regulated D.C. power supplies. Available in portable or stationary types, these units operate from either 220 or 440 volt, 3 phase, 60 cycle A.C. mains and are available in any desired output voltage and current ratings.

features

EXCELLENT VOLTAGE REGULATION—Within ± 1% from no load to full load, with line voltage fluctuations of ± 10%.

FAST RESPONSE—Recovery time under extreme load changes within 0.2 seconds.

LOW RIPPLE—Filter section effectively removes A.C. ripple to less than 1% r.m.s.

These power supplies are equipped with *magnetic amplifier voltage regulators* which are wear-free, extremely rugged, reliable and completely insensitive to vibrational damages or burn-out failures.

Built-in forced air cooling system insures efficient operation at full loads. General design emphasizes neat, in-line assembly and wiring, improving accessibility of all components. Quotations on individual requirements gladly given.

HUFFORD MACHINE WORKS, INC.

Electronics Division

2800 CARMELINA AVENUE, LOS ANGELES 64, CALIFORNIA

DC-7 NEVER BEFORE

such Magnificence . . . such Power
such Performance!

and NEVER BEFORE has the A. W. HAYDON COMPANY *been so proud of its contribution...*

In the never-ending conquest of the vast barriers of space and time, Douglas goes ever forward meeting every challenge that men and machines must face. The newest — and brightest — star in the aviation firmament, the Douglas DC-7, is truly a miracle of the mastery of men over machines . . . and in this great work sixteen A. W. Haydon timing devices play an important part.

We at A. W. Haydon take pride in our contribution toward bringing a mass of metal and machinery into integrated performance which meets Douglas' high standards. Integrated performance is born of a multitude of small component parts, working in perfect mechanical and electrical coordination. The A. W. Haydon precision timing instruments are a vital part of this vast network.

DOUGLAS

DOUGLAS DC-7, the ultimate in comfortable and safe air travel. Swift, luxurious, dependable — the new DOUGLAS DC-7 justly deserves the accolades it is receiving.

- ✓ A. W. Haydon Time Delay Relay is a very important component of the automatic prop feathering system.
- ✓ A. W. Haydon Time Delay Relay times duration of prop feathering.
- ✓ A. W. Haydon Repeat Cycle Timer is a vital part of the prop deicing equipment.
- ✓ A. W. Haydon D.C. Timing Motors are used in the cabin pressurization systems.

When timing poses a problem — consult

(Catalog sent on request)

The A. W. HAYDON COMPANY
222 NORTH ELM STREET
WATERBURY 20, CONNECTICUT
Design and Manufacture of Electro-Mechanical Timing Devices

ing has probably the best success record of any of the current crop of missiles. Manufactured on a build-and-fly basis by Martin for the Naval Research Lab, the Viking design stays fluid so that latest test information can be fed back into the layout of the next round. Viking was completely changed with round No. 8: its fineness ratio was reduced and delta fins replaced the trapezoidal ones. The single-stage rocket altitude record of 136 miles is held currently by Viking.

What About Tomorrow?

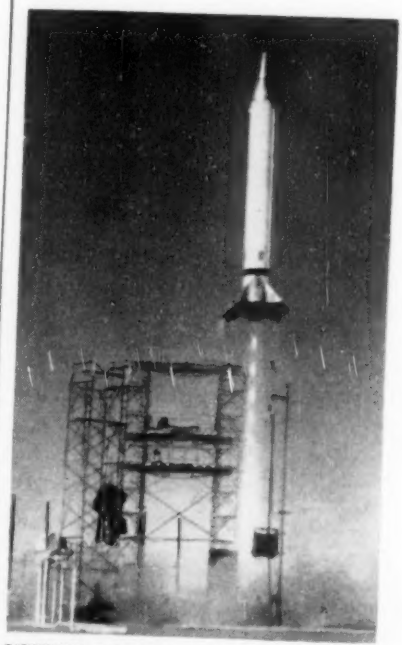
All these are milestones on a missile road which stretches back about 10 years in time and at least four billion dollars in money. None of the missiles in production today is operational at anything like the effectiveness expected by its designers.

But if we had to push the button tomorrow, we could send some missiles off in the direction of the enemy. To that extent, there has been progress.

But what of the industry needed to back up a large-scale use of these missiles? Could the country produce enough hydrazine in the future to justify designing a missile around that propellant now?

How many J57 turbojets can we afford to build and throw away with only one using? How many electron tubes? How much platinum, gold, silver, tungsten, copper, chrome, cobalt?

In short, what is the guided missile going to cost—not per unit—but per offensive?



VIKING 9 heads for altitude record.

First jet-to-jet refueling, accomplished with Probe and Drogue equipment built by Flight Refueling Inc.

PROBE and DROGUE REFUELING

Automatic, light in weight, FR equipment requires no special crew member, permits simultaneous refueling of several fighters.

FR package equipment, quickly mounted in bomb bay, turns bombers into tankers, gives carrier-based fighters far greater range.

The latest, simplest, most adaptable in-flight refueling method is Flight Refueling's Probe and Drogue system perfected after twenty years of experiment and development.

Pioneering in refueling—which adds great range to the swiftness of jet flight—has been the singular task of the Flight Refueling organization. FR equipment made possible the first non-stop round-the-world flight, the first non-stop trans-Atlantic jet flight, the first refueled combat operation and now the first jet-to-jet aerial refueling.

To meet increased requirements, a new modern plant is nearing completion at Baltimore's huge Friendship Airport and will soon be producing FR Probe and Drogue equipment at a greatly accelerated rate.

FLIGHT REFUELING
INCORPORATED
Friendship International Airport · Baltimore 3, Md.

TUPOLEV-200

Aviation Week Sources Behind Iron Curtain Reveal . . .

Reds Put Muscle on Strategic Air Arm

Production of two new turboprop bombers, continuing replacement of obsolescing planes, and new development projects underline formidable airpower effort.

The Russians are putting a major development and production program behind their slowly growing strategic bombing force in an effort to develop a formidable capability for delivering atomic and hydrogen bombs on intercontinental targets.

Although the bulk of the operational Russian bomber strength now based in the European and Asiatic Arctic is still piston-engine Tupolev-4 types copied from the Boeing B-29, a new turboprop bomber similar to the Convair B-36 is already in squadron service and another sweptwing turboprop bomber is in production (Aviation Week Feb. 15 p. 12).

At the same time the long-range bomber production program is swinging into high gear, facilities of the Russian and Communist satellite factories that have been turning out the MiG-15 fighter at an astonishing rate are being re-tooled for large-scale production of a new jet fighter.

This buildup in the offensive strength of Red airpower was predicted exclusively in this magazine more than three years ago (AVIATION WEEK Feb. 26, 1951, p. 174). It has been conducted at great speed and under rigid security conditions. The closely-guarded bomber development program has produced two new intercontinental weapons:

• **Tupolev-200.** This long-range heavy bomber is powered by six turboprop engines and greatly resembles the Convair B-36. The Tu-200 also features a radar bombing system. This bomber is already in squadron service, but estimates of the total number produced vary from less than 100 to several hundred.

• **Ilyushin-38.** This is a new sweptwing bomber powered by four turboprops of the same type used in the Tu-200. The Il-38 is also equipped with a radar bombing system and is known to be in production. It falls about midway between the Boeing B-47 and B-52 in size.

These two advanced designs are backed up by a fleet of about 700 aging but operational Tu-4s, Tupolev's copy of the Boeing B-29.

This Tu-4 fleet is now deployed at bases on Kamchatka and other peninsulas reaching out from the Soviet mainland into the Arctic toward North America. It is backed by a reserve of several hundred additional Tu-4s not assigned to operational units.

But the Reds have not neglected the defensive aspects of airpower in favor of the bomber fleet. During the past few months these seven new Russian designs have been reported by AVIATION WEEK sources behind the Iron Curtain:

• **Lavochkin 17 modification for ground support,** powered by a single turbojet and carrying a two-man crew. Armament is four 23-mm. cannon.

• **Ilyushin 28-2 light bomber,** developed as a major modification from the Il-26 series. Plane is now sweptback, but otherwise resembles its predecessor.

• **MiG-17 all-weather fighter,** radar-nosed twin-jet modification of the MiG-15 of Korean fame. Plane mounts four 23-mm. cannon.

• **Lavochkin flying-boat fighter,** a two-seat, single-jet waterbased craft.

• **Rocket interceptor,** based on the Junkers S-263, a production development of the German Me-163.

• **All-weather fighter with swept-forward wings,** drawing heavily on German wartime research on sweptwing design. Plane has two jets, spans about 68 ft.

• **Delta-wing medium bomber,** powered by four turbojets and spanning about 65 ft. This new design, together with the rocket interceptor and swept-forward fighter, are under development by a team of ex-German designers headed by top Heinkel engineer Siegfried Guenther. The team works at the Red experimental station at Podberesje.

► **Regular Roster**—These new airplanes are not all operational. Currently the

ILYUSHIN-38

Red air force and naval units are flying about 40 different types of fixed- and rotary-wing craft in Russia and the satellites. Some of the aircraft are new, like the turboprop bombers. Some are becoming obsolescent like the MiG-15 and the Il-26 series. Some are completely outmoded, such as the Pe-3 medium bomber.

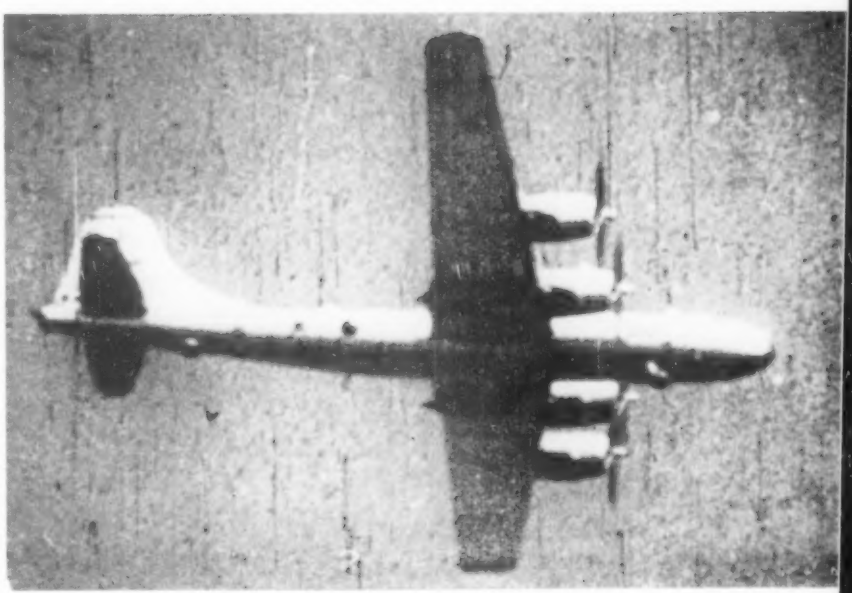
Probably no more than a dozen of these 40 types are in actual production in the Soviet Union today.

To these piloted aircraft must be added the uncertain strength of Russian missile developments. Reported at every level, from the mere copying of inferior German wartime weapons to the service status of intercontinental multistage rocket missiles, the Red pilotless aircraft program presents a cloudy intelligence enigma.

Greatest defensive strength of the Red air force is still in the huge numbers of MiG-15 variants scattered throughout the Communist sphere of influence. More than two-thirds of that strength is the older MiG-15 used in Korea. A newer model with afterburner and a gunsight based on North American F-86 Sabre equipment is in squadron strength and replacing the older model. The MiG-17 twin-engine fighter is just coming into squadron service with the Reds.

The MiG-15 production program provided a surprising demonstration of Russian ability to manufacture modern highspeed jet aircraft. Although factories in the satellite countries were employed to augment Russian fighter production, the total MiG-15 output far exceeded the total production of the United States, Canada and Australia on the North American F-86

MIG-15



TUPOLEV-4

Synchro Control Transformer
(Actual Size)

Geared Servo Motor
(Actual Size)

Servo Motor-Tachometer Generator
(Actual Size)

miniature
precision components
for high-performance

Servo Systems

Developed and produced by Kearfott, these units exemplify accomplishments of creative engineering teamed with production skill providing performance values of accuracy, speed of response and reliability unique for their size. Advanced design techniques are typified by the unitized stator and housing construction, permitting line-bored relationship of stator and rotor. This makes practical the extremely close concentricity tolerances apparent in improved efficiency of the Servo Motors and the very high accuracy of the companion Synchro. A very rugged structure, stable under extremes of environmental exposure is also provided.

Conforms dimensionally to Navy BuOrd Size 11 (Maximum Diameter 1-1/16")

TECHNICAL INFORMATION

Synchro—Available as Control Transformer, Transmitter, Resolver, Differential, for 26 or 115 volt 400 cycle operation. Maximum error tolerance is 7 minutes of arc. The hardened pinion shaft may be used as a spline. Terminals for convenient installation and replacement are provided. Other synchros for 60 cycle operation may be obtained. (Basic Type R500).

Servo Motor—The Servo Motor (Basic Type R1191 features a very high torque-to-inertia ratio. Motor input is 3.5 watts per phase at 115 volt 400 cycle. Available with high-impedance control winding for operation directly in plate circuit of an Amplifier. Integral precision gear train can be provided. Many other models available including Servo Motors for 60 cycle duty. (Basic Type R303).

Servo Motor-Generator—The motor described above is available with an integral high performance damping generator, providing an output signal of 1/2 volt per 1000 RPM over a 5500 RPM speed range. (Basic Type R804).

See us at the Radio Engineering Show, Booth 722, Airborne Avenue, March 22-25, Kingsbridge Armory, Bronx, New York.

Technical Data on these and other components is available on request.

KEARFOTT COMPONENTS INCLUDE:

Gyros, Servo Motors, Synchros, Servo and Magnetic Amplifiers, Tachometer Generators, Hermetic Rotary Seals, Aircraft Navigational Systems, and other high accuracy mechanical, electrical and electronic components.

Kearfott
SINCE 1917

KEARFOTT COMPANY, INC., Little Falls, N. J.

Midwest Office: 188 W. Randolph St., Chicago 1, Ill., West Coast Office: 253 N. Vinedo Ave., Pasadena, Calif.

A GENERAL PRECISION EQUIPMENT CORPORATION SUBSIDIARY

■ RUSSIAN AIRPOWER

Sabre for the same period.

The Russians also put the MiG-15 through several model improvements during this large-scale production program, comparable to the Sabre development from F-86A to F-86F.

In addition to equipping the Red air force fighter squadrons, the MiG-15 production program also provided thousands of this sweptwing fighter for the Czech, Hungarian, Polish, Chinese and North Korean air forces. The production program for the Il-28 was also of sufficient magnitude to provide the satellite air forces with substantial quantities of this twin-jet bomber that has tactical atomic capabilities over an 1,800-mile range.

▶ **All-Weather Units**—Two Red designs, handle the nightfighting aspects of defensive warfare—the Il-26, and new MiG-17s. Reports reaching AVIATION WEEK indicate that the Russians are using airborne interceptor control techniques in their simulated home-defense missions.

The control center is the old Pe-2 bulging with radar gear. It cruises near its maximum altitude and vectors the MiGs toward the target. Recent maneuvers of the Red air force tested the efficiency of this method.

One controversial item on the Red roster is the rocket-propelled fighter. There have been repeated reports of interceptor developments based on the German Messerschmitt 163, which was later turned over to Junkers for production redesign as the S-263.

According to these reports, squadrons of the rocket fighter are in service. But AVIATION WEEK sources say that the development program for these unusual planes is turned on and off, depending on how the winds of top-level policy blow.

As of June 1953, this development program was being pursued, but there were no airplanes in service. Later in the fall, the entire program was canceled.

It is not known yet whether work is under way again.

▶ **Ground Support**—Indications are that the Reds were slow in providing new designs for ground support, the traditional task of their air service. Until the end of 1953, all ground-support units were equipped with Il-10s—slightly modernized versions of the old Stormovik of World War II—and with Pe-2s, another old aircraft.

Recently the La-17 long-range fighter has been adapted for the job of ground support. Rebuilt into a solid-nosed, two-place attack craft, the La-17 is entering squadron service with the Russians.

Apparently this aircraft, built as a backstop at the same time the MiGs

were in production, never measured up to the standard interceptor.

The La-17 saw limited service in Korea during the winter of 1951-52 but did not distinguish itself in air-to-air combat with the Sabre.

Older model MiG-15s are also being assigned to ground-support duties in considerable number.

One of the unsolved puzzles of Russian aviation is the scope and effectiveness of their pilot training program. It is obvious that a large quantity of well-trained pilots is required to man the fighter forces, in addition to the growing demand for aircrews to operate the steadily increasing bomber fleet.

Some indications of serious deficiency in training were evident in Korea where the general skill level of pilots encountered by USAF Sabre pilots was low, and in the extremely limited number of flying hours logged by the two Polish MiG-15 pilots who fled to Denmark with their planes.

The training problem for aircrews capable of handling long-range gas-turbine-powered bombers and radar bombing systems is even more complex as USAF's Strategic Air Command can testify. However it seems safe to assume from the determination and effort poured into the solution of other Russian aviation problems that whatever pilot deficiency now exists may not persist for long.

▶**Light Bombers**—The Russians erred in their selection of the Type 150 for tactical bombing. Developed as a much-reworked version of a Junkers wartime design, the Type 150 never lived up to its advance performance calculations.

As a stopgap measure, the Il-28 was modified by the replacement of its straight wing with a swept planform and the installation of engines with about 10% more thrust (AVIATION WEEK Jan. 11, p. 14).

Most squadrons have been equipped with the straightwing Il-28 for some time; the newer Il-28-2 sweptwing modifications are being rushed into service as long-overdue replacements for the straightwing bomber.

▶**Naval Units**—Latest reports say the Russians have three aircraft carriers in operation. Most of the planes are MiG-15s with arresting gear; a few older divebombers complement the MiGs.

Other than the one prototype flying-boat fighter observed last year (AVIATION WEEK Aug. 24, 1953, p. 11), no new waterbased aircraft have been reported.

There is a new torpedo bomber of recent vintage—tentatively designated the Tu-12—which is land-based. It resembles the Il-28 series, and carries two 20-in. torpedos in its slim fuselage.

The Il-4, used for the torpedo task during World War II, has been relegated to training status.

▶**Helicopters**—Two neat helicopter designs, credited to Mikhail Mil, have appeared in recent air displays at Moscow's Tushino airport. Both are single-engine, single-rotor craft, resembling the Sikorsky S-51 and S-55 externally.

There have been no reports of helicopters in military service in Russia or the satellites. Liaison and communication tasks continue to be handled by a collection of venerable biplanes and monoplanes in the 100-hp. category.

This picture of Red air strength shows a steady and in some cases spectacular growth of a modern gas-turbine-powered air force backed by engineering and production effort required by the tremendous technical advances of post-war aviation. American observers of the Russian aviation scene still tend to underestimate gravely the Soviets' technical skill, production capacity and the tenacity with which they are carrying out their publicly announced policy of trying to building an air force second to none.

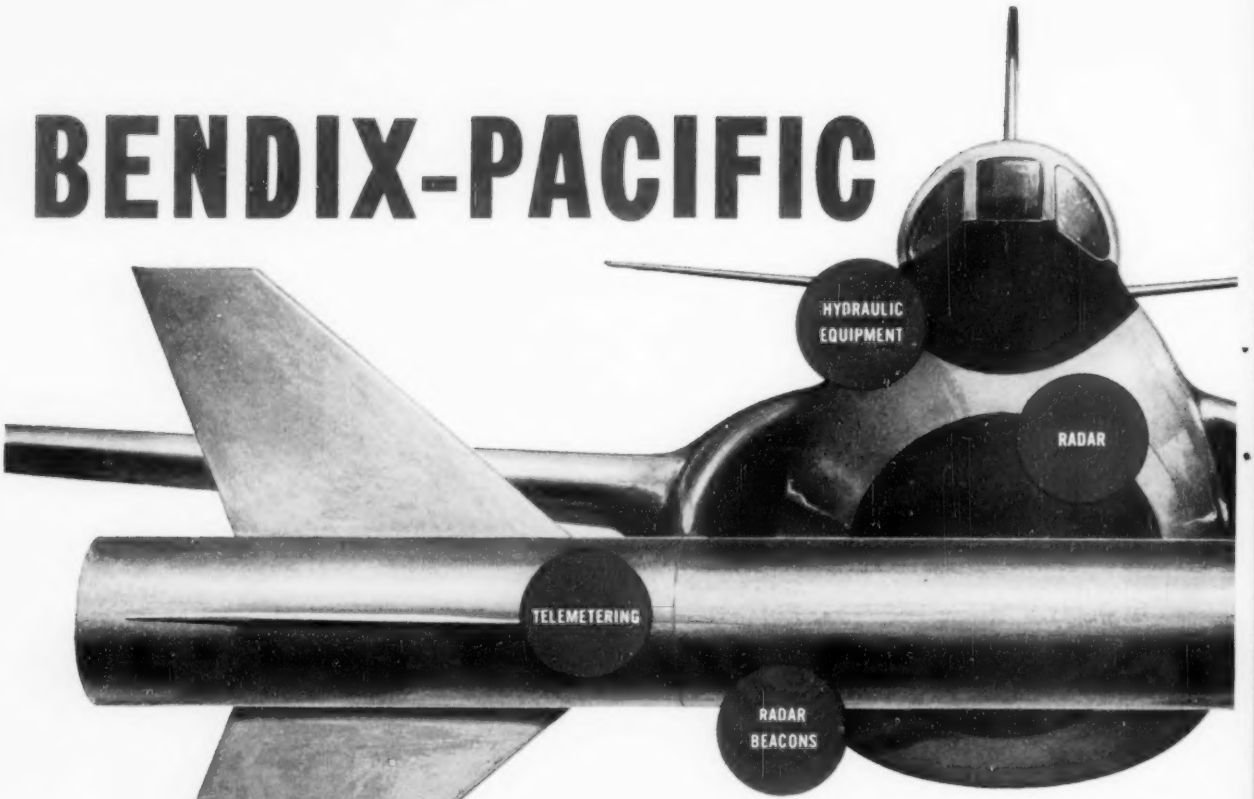
One of the factors that can easily throw an American view of Russia out of focus is the simple fact that while only a relatively small portion of American technical skill and productive capacity is being used for the development of air-atomic capability, a much higher percentage of available Russian resources is being applied to the same problem. In absolute measurement of effort devoted to military airpower the Russians may well be exceeding our own.

Emergence of the Russian strategic air force is the end result of only 10 years of development. It is an accomplishment that has been a rude jolt to technical observers this side of the Iron Curtain. That jolt is even harder for U.S. experts to take when they con-

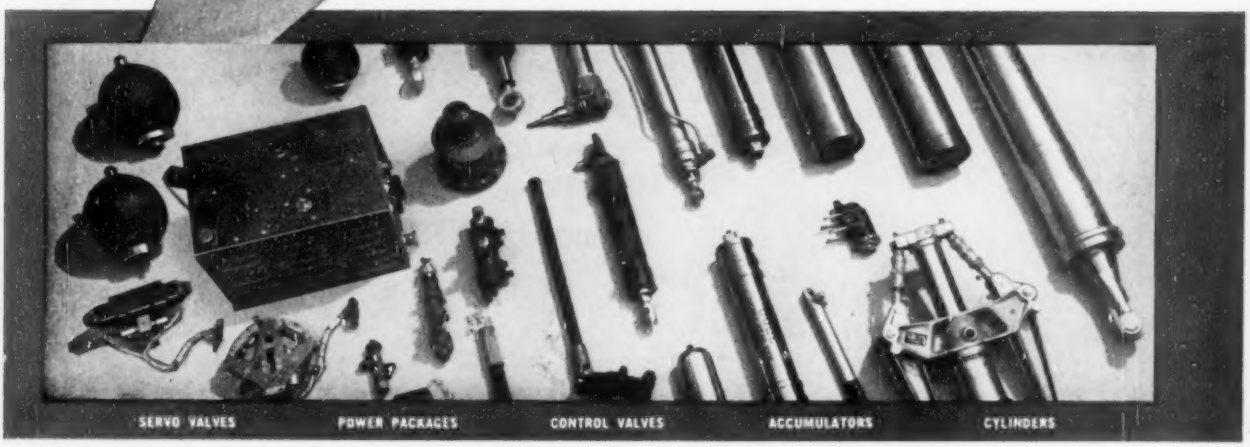
MIG-17

LAVOCHKIN-17-2

BENDIX-PACIFIC

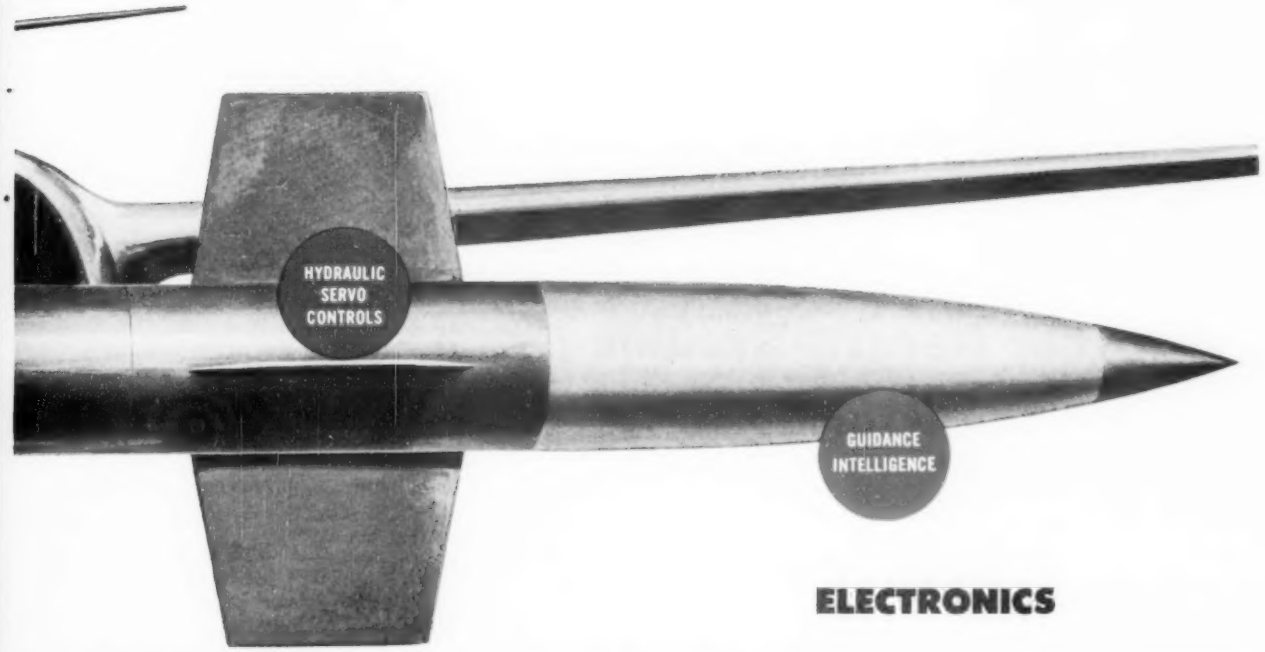


HYDRAULICS

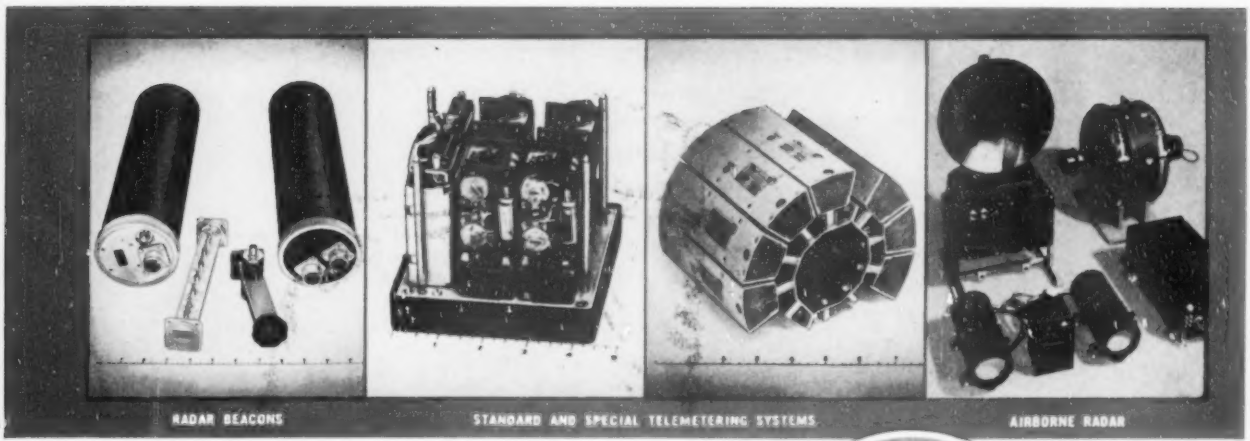


Pacific Division is proud of its advanced developments in airborne hydraulic controls and specialized electronic equipment. Bendix-Pacific is in the unique position of being able to capably engineer and produce composite systems involving the integration of electronic and hydraulic components. Typical of this *Systems Concept* is a radar which feeds transfer functions to the servo valves which in turn control the wing actuating cylinders. Pacific Division has been active in the fields of airborne hydraulics, electronics and remote control since 1937. There is no substitute for this store of experience which we can offer you.

HYDRAULIC AND ELECTRONIC SYSTEMS AND COMPONENTS



ELECTRONICS



RADAR BEACONS | STANDARD AND SPECIAL TELEMETERING SYSTEMS | AIRBORNE RADAR

Let us consult with you on your hydraulic and specialized electronic problems. Write or wire us today.

BENDIX PACIFIC

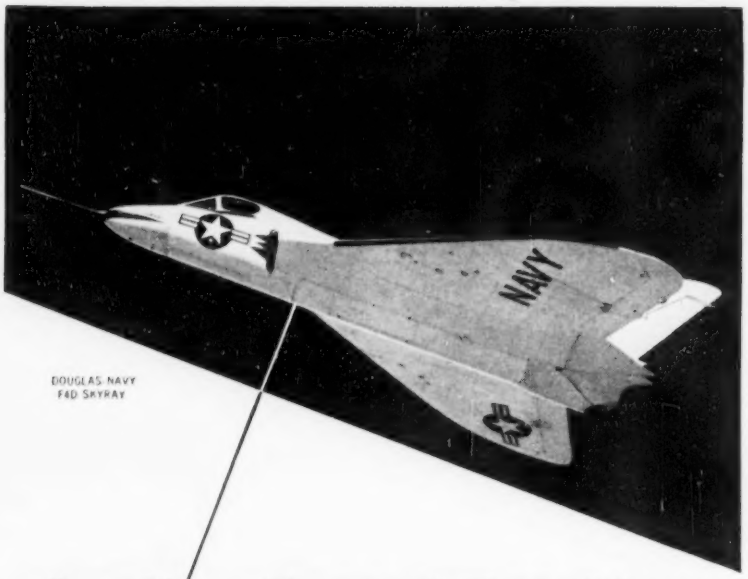
PACIFIC DIVISION • Bendix Aviation Corporation

11600 Sherman Way, North Hollywood, California

East Coast Office: 475 5th Ave., N.Y. 17

Export Division: Bendix International 205 E. 42nd St., N.Y. 17

Canadian Distributors: Aviation Electric, Ltd., Montreal 9



DOUGLAS NAVY F4D SKYRAY

Another Record-Breaking Performer

equipped with

Camloc Fasteners

Streaking over California at more than 750 miles per hour, the Douglas-Navy F4D Skyray handily set a new official world's speed record. In designing panels and access doors into its sleek "skin" to minimize friction and withstand excessive loads at high speed, Douglas engineers specified Camloc Fasteners. These quarter-turn fasteners not only hold with a powerful grip, but release easily and quickly for faster maintenance.

In many military and commercial planes throughout the world, Camloc Fasteners provide safer, quicker, more economical fastening.

Camloc®

FASTENER CORPORATION

55 Spring Valley Road, Paramus, N. J.

WEST COAST OFFICE: 5410 WILSHIRE BLVD., LOS ANGELES, CAL.

■ RUSSIAN AIRPOWER

sider the immense drain of engineers, manpower and material that went into the purely defensive aspects of Russian airpower, the buildup and supply of the Communist air forces in the satellite countries, and the replacement of air materiel in Korea.

The new policy was adopted toward the end of World War II by top Russian military brass. During that conflict, the Russian air force managed to mount very few bombing raids on Germany. Those efforts showed them their weakness. The joint US-British strategic bombing that blasted German industry into rubble showed them what airpower could do.

The atomic bombs that rocked Hiroshima and Nagasaki supplied the final lesson.

Linked by tradition to the ground-support mission, the Russian air force broke its time-forged chains in the immediate postwar period in time to ride the crest of the jet-powered technical revolution that forced all of the great nations of the world to build their airpower anew. To aid Russian technology, a sizeable portion of German engineers and scientists were imported and have made substantial contributions to the growth of the postwar Soviet air force.

In retrospect it is easy to discern the tremendous effort Russia has devoted to building its postwar airpower—an effort about which the United States has been duly warned but still tends to underestimate.

Since 1946 the Russians have built a fleet of long-range piston bombers equivalent to our B-29s, which are still in active service with SAC. They have produced a jet fighter force that boasts more modern sweptwing interceptors than the combined NATO powers. They have built a military air transport system equipped with twin- and four-engine planes to link their extensive airbase network.

They are now well along on building a fleet of gas-turbine-powered long-range bombers capable of carrying the atomic and hydrogen bombs also developed by Soviet scientists.

But just as in the case of the atomic bomb, the Russians did not ignore the chance to brag about their strength.

An unnamed Russian general, writing in the official Moscow newspaper "Izvestia," says this:

"In the United States, a great deal is written on the so-called global, intercontinental or trans-ocean strategy. The authors of these theoretical exercises picture a war as if their adversaries had no means of embarking on this kind of strategy.

"Would it not be wiser to assume the opposite?"

EXPERIENCE + RESEARCH + PERFORMANCE

= LEADERSHIP in

Servo Motor the size of a Penny

SYNCHROS
SERVO MOTORS
RESOLVERS

Ketay

PRODUCES THE
COMPLETE RANGE
OF SIZES AND TYPES
TABULATED ON THE
FOLLOWING PAGES...

Typical characteristics of some of the uni

TWO PHASE SERVO MOTORS

TYPE	FRAME SIZE	MK	MOD	MIN. TORQUE AT STALL (IN OZ.)	NO LOAD SPEED (MIN.)	POWER PHASE AT STALL (WATTS)	NO. OF POLES	OPERATING FREQUENCY	RATED VOLTAGE EXCITATION FIXED PHASE	CONTROL PHASE SERIES	CONTROL PHASE PARALLEL
K402350	10			.13	9600	1.5	4	400	18 18 *		
K402400	10			.13	9600	1.5	4	400	18 18 *		
K402390	10			.3	6200	2.7	6	400	26 26 *		
K402300	11	14	2	.63	6200	3.5	6	400	115	115	57.5
K402310	11			.35	6200		6	400	50 26 *		
K402290	11			.45	6200	3.5	6	400	115	115	57.5
K402380	15			1.45	3200	5.0	2	60	115	115	57.5
K402470	15			1.3	1600		4	60	24 24 *		
K101600-6	15	7	0	1.45	4800		8	400	115	115	57.5
K101650-5	15	7	2	1.45	4800	6.1	8	400	115	230	115
K101660	15	7	1	1.45	4800	6.1	8	400	115	115	57.5
K402410	15			.28	4800	6.1	8	400	40 50 *		
K402420	15			.28	4800		8	400	26 50 *		
K402430	15			.28	4800		8	400	50 26 *		
K402440	15			.28	4800		8	400	42 42 *		
K402150	15			1.3	6200	6.1	6	400	115 26 *		
K402550-1	18	8	0	2.35	4800	9.2	8	400	115	115	57.5
K402550-2	18	8	1	2.35	4800	9.2	8	400	115	115	57.5
K402560	18	8	2	2.35	4800	9.2	8	400	115	282	141
(1) 113E1Y	23			7.5	3500	14.0	2	60	115	115	57.5

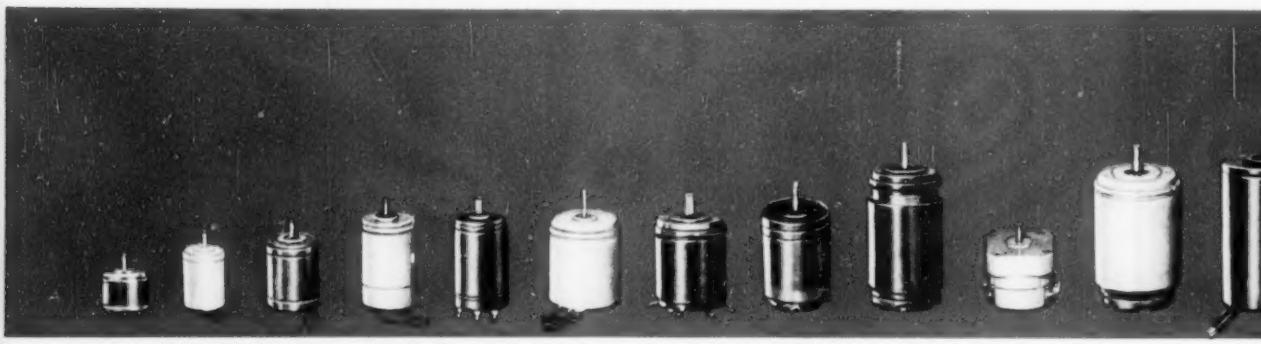
(1) Also for 115 or 230 operation on control phase

*Denominator refers to control phase excitation

SYNCHRO CO

TYPE	FRAME SIZE	MK	MOD
(1) K101530	10		
K101560	10		
11CT4a	11	24	1
K101300	15		
(2) K402100			
K101750	15		
15CT4a	15	14	1
K101800	15		
16CTB4a	16	21	1
18CT4a	18	15	1
18CT6a	18	25	0
19CTB4a	19	22	1
19CTB6a	19	27	0
11HCT	1		
23CT4	23		
23CT6	23		

(1) High Imped
(2) Linear synch
(3) When used



1 2 3 4 5 6 7 8 9 10 11 1

SYNCHRO RESOLVERS

TYPE	FRAME SIZE	TOTAL NULL VOLTAGE MAX. AT TEST VOLTAGE	TEST VOLTAGE	INPUT IMPEDANCE Ohms	VOLTAGE RATING	ANGULAR DISTANCE BETWEEN NULL VOLTAGE	MAXIMUM ANGULAR ACCURACY	OPERATING FREQUENCY*
K101580	10	200 MV	26/12	600	26/11.8 VAC	90° ± 5'	30'	400
(1) K101590	10	200 MV	26/12	2500	26/11.8 VAC	90° ± 5'	30'	400
101D2A	11	60 MV	26	1400/70°	26/22 VAC	90° ± 30'	± 10'	400
101D2C	11	60 MV	26	440/76°	26/11.8 VAC	90° ± 15'	± 10'	400
D13640	11	30 MV	26	1510/71°	26/22 VAC	90° ± 30'	± 10'	400
D13800	15	75 MV	50	2740/83°	50/50 VAC		±.3°	500
(2) 105D2A	15	30 MV	30	2730/80.5°	10/10 VAC	90° ± 5'	±.1°	400
105D2Z	15	40 MV	26	900	26/26 VAC	90° ± 20'	±.12°	400
(2) D13610	15	30 MV	24	(4)	(4)	90° ± 5'	±.2°	1000 (Test)
D11960	15	25 MV	26	585/81°	26/11.8 VAC	90° ± 5'	20' Spd	400
K101450	15	200 MV		(1970/75° / 274/28°	26/18 1/2	Single phase Single phase	40' 40'	400 30(
D13310	15	30 MV	26	740/80°	26/26 VAC	90° ± 5'	±.10%	400
(2) D13820	15	15 MV	15	889/78°	26/26 VAC	90° ± 5'	±.10%	400
K101340	15	200 MV	26/12	440/75°	26/11.6 VAC	90° ± 5'	20' Spd	400
(2) D13320	23	30 MV	24	(4)	(4)	90° ± 5'	±.2°	1000 (Test)
D13600	23 (3)	50 MV	50	7000	50/50 VAC	90° ± 30'	± 5'	500
D13650	23	30 MV	30	3200/85.7°	30/30 VAC	90° ± 5'	±.15%	350
D13350	23	10 MV	8	975/86.4°	8/16 VAC	90° ± 5'	± 8'	400
D13810	23	30 MV	30	3200/85.7°	30/30 VAC	90° ± 5'	±.15%	350
23RS6B	23	15 MV	26	1000	26/26 VAC	90° ± 2.5'	±.1%	60
23RS6S	23	30 MV	24	480/78°	24/24 VAC	90° ± 5'	±.2%	60
D13440	23	90 MV	90	2700/73.8°	90/90 VAC	90° ± 5'	±.1%	400
23RS6	23	60 MV	60	585/61°	90/90 VAC	90° ± 5'	±.2%	60
23RS6A	23	30 MV	24	570/79°	45/45 VAC	90° ± 5'	±.2%	60
23RS4	23	60 MV	60	720/80°	90/90 VAC	90° ± 5'	±.2%	400
23RS4A	23	60 MV	60	234/83°	90/90 VAC	90° ± 5'	±.2%	400
23RS4B	23	20 MV	26	550/86°	26/26 VAC	90° ± 5'	±.10%	400
23RS4C	23	30 MV	60	3200/86°	90/90 VAC	90° ± 5'	±.10%	400
(2) 23RS4D	23	30 MV	60	3200/86°	90/90 VAC	90° ± 5'	±.10%	400

(1) High impedance unit
(2) Feedback Resolver
(3) Geared housing

(4) For these Sweep Resolvers input impedance is not considered. Instead, inductance at 1000 c.p.s. is important.

Inductance at 1000 c.p.s.	D13320	D13610
Rotor winding	17.7 Mh	27 Mh
Main Stator winding	16.2 Mh	24.6 Mh
Feedback Stator winding	16.2 Mh	24.6 Mh

INDUCTIO

TYPE	FRAME SIZE	DUTY	OPERATING VOLTAGE
D11940	18	Continuous	3 Phase 115 V
E11590	20	Intermittent	2 Phase 115/4
E11600	1	Intermittent	3 Phase 115 V

(1) SERVO MOTOR, Size 10 Frame, O.D. .937"

(2) SYNCHRO, Size 10 Frame, O.D. .937" (Transmitter, Receiver, Resolver, Differential Transmitter, Control Transformer)

(3) SERVO MOTOR, Size 10 Frame, O.D. .937"

(4) SYNCHRO, Size 11 Frame, O.D. 1.062" (Transmitter, Resolver, Control Transformer)

(5) SERVO MOTOR Mk 14, Size 11 Frame, O.D. 1.062"

(6) SYNCHRO, Size 15 Frame, O.D. 1.437" (Transmitter, Receiver, Resolver, Differential Transmitter, Control Transformer)

(7) SERVO MOTOR Mk 7, Size 15 Frame, O.D. 1.437"

(8) SYNCHRO, Size 15 Frame, O.D. 1.437" (Transmitter, Receiver, Resolver, Differential Transmitter, Control Transformer)

(9) SYNCHRO, Size 16 Frame, O.D. 1.537" (Transmitter, Receiver, Control Transformer)

(10) LINEAR TYPE CONTROL TRANSFORMER, O.D. 1.625"

Ketay Ma
555

Write for Additional Copie

units in current volume production by Ketay

HRO CONTROL TRANSFORMERS

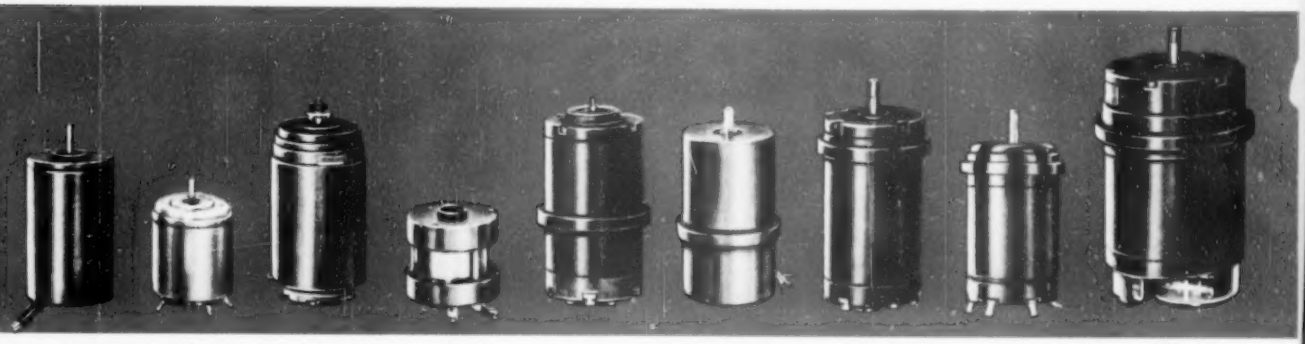
MOD	VOLTAGE RATING	OPERATING FREQUENCY	ELECTRICAL ACCURACY MAX. ERROR
	26/11.8 VAC	400	24' SPD.
	26/11.8 VAC	400	30' SPD.
1	90 1V per deg	400	±7'
	[3] 11.8 22 VAC	400	20' SPD
	10 Volt Input	400	
	11.8/22 VAC	400	15' SPD.
1	90/1V per deg	400	±10'
	[3] 11.8 22 VAC	400	20' SPD.
1	90/1V per deg	400	±10'
1	90/1V per deg	400	±8'
0	90/1V per deg	60	±8'
1	90/1V per deg	400	±8'
0	90 1V per deg	60	±8'
	90/1V per deg	60	±18'
	90/1V per deg	400	±6'
	90/1V per deg	60	±6'

High Impedance unit
Linear synchro
When used as control transmitter 26 11.8 VAC

SYNCHRO RECEIVERS

TYPE	FRAME SIZE	FUNCTION	MK	MOD	VOLTAGE RATING	OPERATING FREQUENCY	RECEIVER ERROR MAXIMUM
K101540	10	Torque Receiver			26/11.8 VAC	400	1.5°
K402020	15	Torque Receiver			115/18.2 VAC	400	.75°
K101430	15	Torque Receiver			26/11.8 VAC	400	.75°
15TR4A	15	Torque Receiver	16	1	115/90 VAC	400	1.0°
16TR84	16	Torque Receiver			115/90 VAC	400	1.0°
18TR4A	18	Torque Receiver	15	1	115/90 VAC	400	1.0°
19TR84	19	Torque Receiver			115/90 VAC	400	1.0°
1F	1	Torque Receiver	8	8	115/90 VAC	60	1.5°
23TR4	23	Torque Receiver			115/90 VAC	400	1.0°
23TR6	23	Torque Receiver			115/90 VAC	60	1.0°
31TDR4	31	Torque Differential Rec.	19	1	90/90 VAC	400	48'
31TDR6S-1	31	Torque Differential Rec.			90/90 VAC	60	*(1)
31TDR6	31	Torque Differential Rec.			90/90 VAC	60	48'
31TR4A	31	Torque Receiver	18	1	115/90 VAC	400	48'
31TR6	31	Torque Receiver	22	0	115/90 VAC	60	48'

*(1) 31TDR6S1—Pigtail Unit, Sensitivity 10'



12 13 14 15 16 17 18 19 20

NDUCTION MOTORS

PERATING VOLTAGE	FREQUENCY	MINIMUM NO LOAD SPEED (RPM)	MINIMUM STALL TORQUE (OZ. IN.)
Phase 115 V	60	3000	3
Phase 115/40	60		.75 at 115 MF 8V CF
Phase 115 V	60	3200	16

, O.D.
.937"
Differ-
ormer)
, O.D.
1.062"
Trans-
Frame,
1.437"
Differ-
ormer)
Frame,
1.437"
Differ-
ormer)
1.537"
Trans-
ANS-

(11) SYNCHRO, Size 18 Frame, O.D. 1.750" (Transmitter, Receiver, Differential Transmitter, Control Transformer)
(12) INDUCTION MOTOR, Size 18 Frame, O.D. 1.750", 3 Phase, 2 Pole
(13) SERVO MOTOR Mk 8, Size 18 Frame, O.D. 1.75"
(14) SYNCHRO, Size 19 Frame, O.D. 1.90" (Transmitter, Receiver, Control Transformer)
(15) INDUCTION MOTOR, Size 20 Frame, O.D. 1.95"
(16) SYNCHRO, Type 1F, 1HCT, or 1HG, Size 1 Frame, O.D. 2.250" (Receiver, Transmitter, Control Transformer)
(17) INDUCTION MOTOR, Size 1 Frame, O.D. 2.250"
(18) SYNCHRO, Size 23 Frame, O.D. 2.250" (Transmitter, Receiver, Resolver, Differential Transmitter, Control Transformer)
(19) SERVO MOTOR, Size 23 Frame, O.D. 2.250"
(20) SYNCHRO, Size 31 Frame, O.D. 3.10" (Transmitter, Receiver, Differential Receiver, Differential Transmitter)

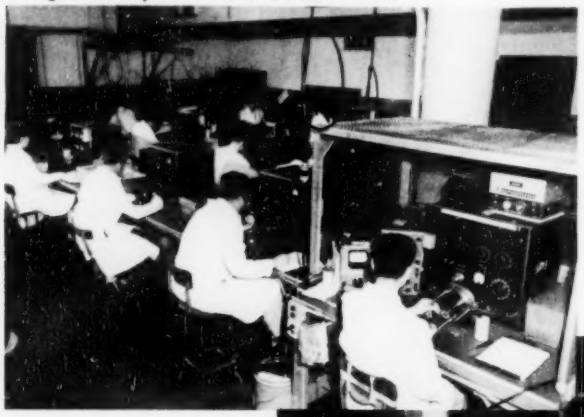
SYNCHRO TRANSMITTERS

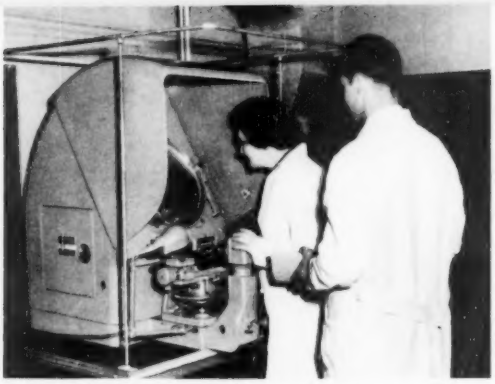
TYPE	FRAME SIZE	FUNCTION	MK	MOD	VOLTAGE RATING	OPERATING FREQUENCY	ELECTRICAL ACCURACY MAX. ERROR
K101500	10	Control Transmitter			26/11.8 VAC	400	24' Spd
K101550	10	Control Transmitter			26/11.8 VAC	400	24' Spd
K101570	10	Control Differential Trans.			11.8/11.8 VAC	400	30' Spd
10CB2J	10	Control Transmitter			26 11.8 VAC	400	20 Spd
11CX4a	11	Control Transmitter			115 90 VAC	400	±7'
K101350	15	Control Differential Trans.			11.8/11.8 VAC	400	20' Spd
K101400	15	Control Transmitter			26/11.8 VAC	400	20' Spd
K101420	15	Control Transmitter			26/11.8 VAC	400	20' Spd
K101480	15	Control Differential Trans.			11.8/11.8 VAC	400	20' Spd
15TDX4a	15	Torque Differential Trans.	28	1	90/90 VAC	400	±10'
15CDX4a	15	Control Differential Trans.	33	1	90/90 VAC	400	±10'
15CX4a	15	Control Transmitter	22	1	115/90 VAC	400	±12'
K101820	15	Control Differential Trans.			11.8/11.8 VAC	400	20' Spd
16 CXB4a	16	Control Transmitter		1	115/90 VAC	400	±12'
18CDX4a	18	Control Differential Trans.	34	1	90/90 VAC	400	± 8'
18TDX4a	18	Torque Differential Trans.	29	1	90/90 VAC	400	±10'
18CX4a	18	Control Transmitter	32	1	115/90 VAC	400	± 8'
18CX6a	18	Control Transmitter	46	0	115/90 VAC	60	±10'
18CDX6	18	Control Differential Trans.			90/90 VAC	60	±10'
19CXB4a	19	Control Transmitter	38	1	115/90 VAC	400	± 8'
1HG	1	Torque Transmitter	14	8	115/90 VAC	60	±18'
23CX4	23	Control Transmitter			115/90 VAC	400	± 8'
23CX6	23	Control Transmitter			115/90 VAC	60	± 8'
23CDX4	23	Control Differential Trans.			90/90 VAC	400	± 8'
23CDX6	23	Control Differential Trans.			90/90 VAC	60	± 8'
23TX4	23	Torque Transmitter			115/90 VAC	400	± 8'
23TX6	23	Torque Transmitter			115/90 VAC	60	± 8'
23TDX4	23	Torque Differential Trans.			90/90 VAC	400	± 8'
23TDX6	23	Torque Differential Trans.			90/90 VAC	60	± 8'
31TDX4	31	Torque Differential Trans.	36	0	90/90 VAC	400	± 8'
31TDX6	31	Torque Differential Trans.			90/90 VAC	60	± 8'
31TX4a	31	Torque Transmitter	35	1	115/90 VAC	400	± 8'
31TX6	31	Torque Transmitter	42	0	115/90 VAC	60	± 8'

Manufacturing Corporation
555 Broadway • New York 12, N. Y.

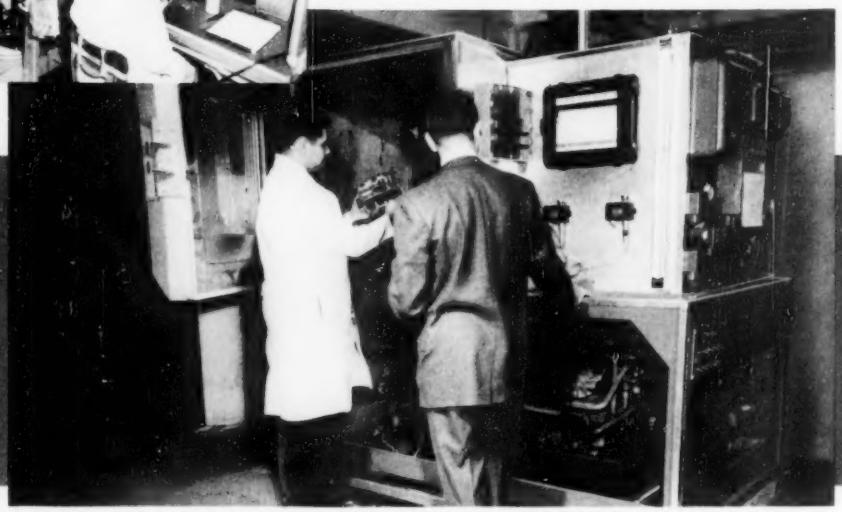
Copies for Your Catalog Files

Skilled technicians performing one of dozens of tests on size 23 Synchros. As design agent for Army Ordnance, Ketay designed all Synchros of this size.





Jones and Lamson optical comparator . . . one of hundreds of different methods (many of them original developments) used to insure precision.



Environmental test chamber can simulate altitudes up to 90,000 feet; produce temperatures to minus 100° F and controlled humidity to 98%. This chamber performs all environmental tests in accordance with MIL-E-5272.

EXPERIENCE + RESEARCH + PERFORMANCE = LEADERSHIP

The final test of leadership is the ability to deliver. Ketay offers:

Original research to meet highly specialized requirements and rigorous operating conditions;

Application of this research to the economical manufacture of high quality products;

Volume production to comply with stringent delivery schedules.

By providing a complete range of sizes and types . . . originality of design . . . facilities for volume production . . . Ketay has established this kind of leadership.

Ketay's experience also includes: gyro components; automatic control devices for fire control and missile systems; computers and simulators; magnetic, resolver and synchro amplifiers; marine inter-communication equipment; ship's course, salinity and other remote indicators; and automatic control systems.

The Research and Development Division is staffed and equipped to participate in advanced studies during the design stage of applications involving Ketay electro-mechanical devices.

SYNCHROS
SERVO MOTORS
RESOLVERS
MAGNETIC AMPLIFIERS
AUTOMATIC CONTROL SYSTEMS

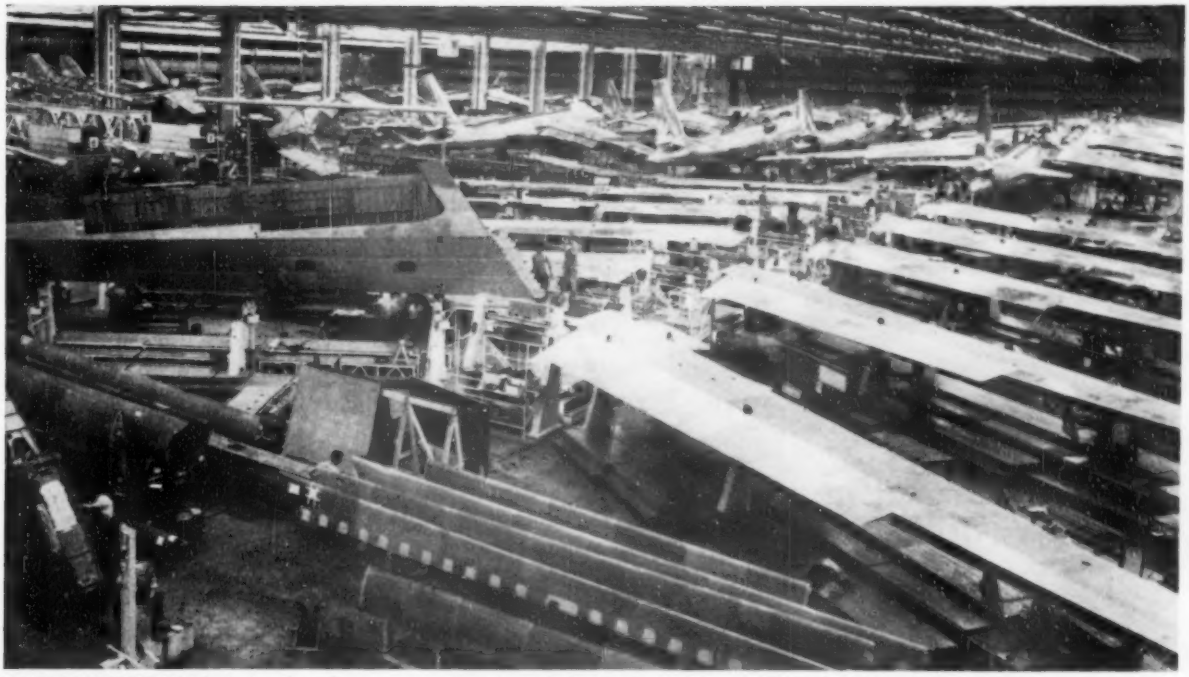
Booth 629-631—I.R.E. Show
Kingsbridge Armory
New York City, March 22-25

Ketay
MANUFACTURING CORPORATION

Executive Offices 555 Broadway, New York 12, N. Y.
Pacific Division, 12833 Simms Avenue, Hawthorne, California

New York Division • Kinetix Instrument Division • Pacific Division
Electronic Instrument Division • Research & Development Division

For further information or additional copies of this catalog sheet write directly to Ketay



MASS PRODUCTION of aircraft and components like these Boeing B-47 wing panels will reach postwar high this year.

Aircraft Manufacturing

New Doctrine Aims to Stabilize Industry

Peak deliveries scheduled for this year with gradual decline to plateau level in 1956. Future net incomes may surpass record year of 1953.

For the first time in its turbulent postwar history the aircraft manufacturing industry can look forward to a period of relative stability and high sales volume.

Aircraft manufacturing will reach its postwar high-water mark during 1954. The floodtide of military orders stimulated by the Korean crisis should reach its crest of deliveries to the Air Force, Navy, Marines and Army this year and then begin a gradual decline in 1955 to reach a maintenance and modernization level in 1956. With few exceptions, airframe, engine, parts and accessory manufacturers already have enough business in their current backlogs to keep their plants busy until 1956.

During 1953 the aircraft manufacturing industry built about 155 million airframe pounds, of which only 10 million pounds represented civil aircraft. About 12,000 military planes were delivered, in addition to some 4,700 commercial transports and utility aircraft.

▶ **More Airframe Weight**—During 1954 the number of military aircraft deliveries will remain at about the 1953 level but airframe weight will continue to increase by another 10%, as a higher percentage of heavy transports and jet bombers swell the military delivery total.

Sales, which reached about $9 billion during 1953, will continue to climb during 1954, paralleling the increase in airframe weight. A decline of perhaps 15% in gross sales looms for 1955, but that year's sales level should still be above the extremely prosperous year of 1952.

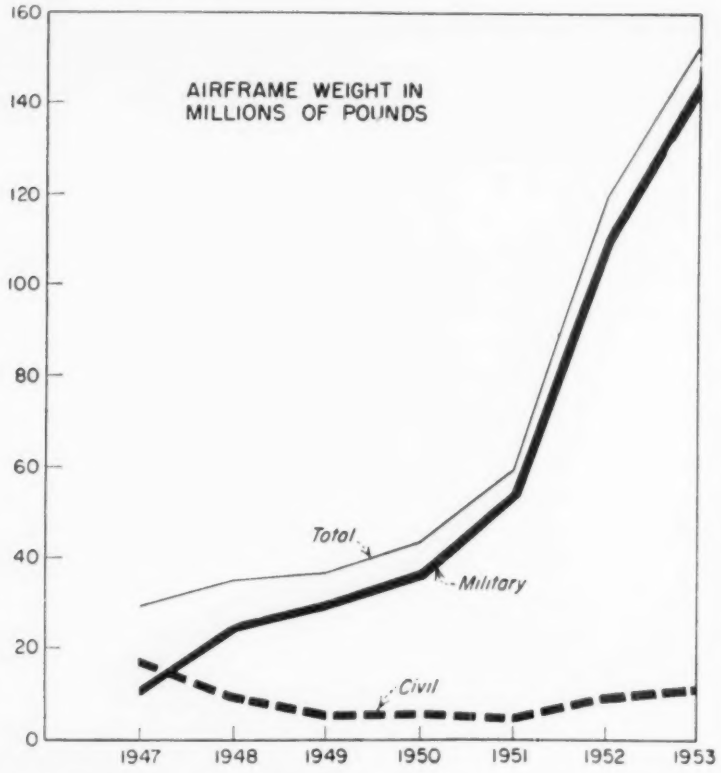
With the expiration of the excess profits tax on Dec. 31, 1953, and prospects for more liberal tax approaches to such key items for aviation managements as depreciation on facilities, and research and development expenditures, and a new determination of allowable costs, it is not unlikely that net income for the industry will surpass even the record mark of 1953 in succeeding years, despite a gradual decline in total sales volume.

▶ **Military Market**—The military market will continue to be the key to the economic health of the aircraft industry.

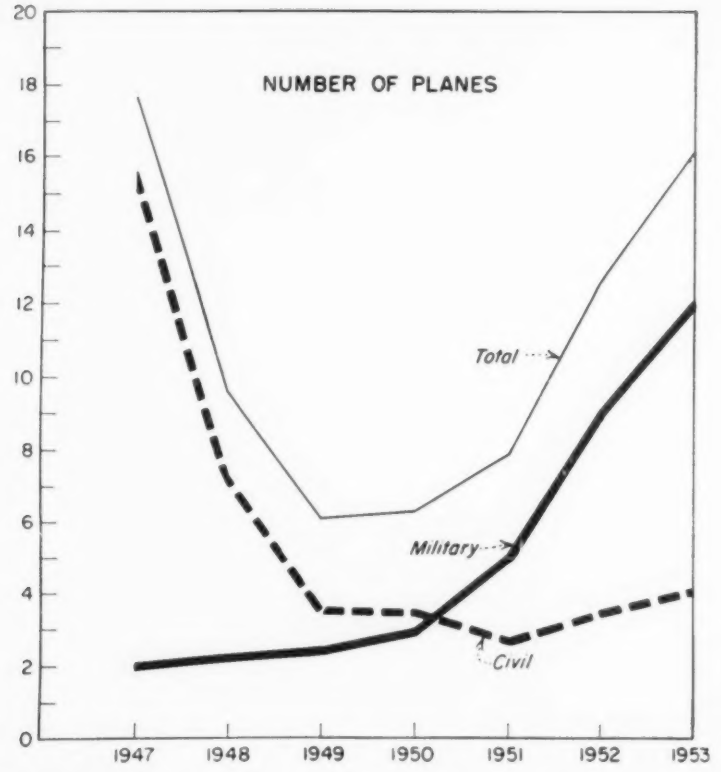
Here is the outlook for military business under new airpower doctrine of the Republican Administration that submitted its first federal budget (covering the fiscal year 1955) early this year.

The aircraft industry still is working on a large part of the $40 billion appropriated for aircraft procurement in the three fiscal years after the outbreak of war in Korea. On Jan. 1, 1954, the Defense Department ledgers carried a total of $27 billion in appropriated but unexpected funds for aircraft procurement. This represents work already contracted for with the industry but still not delivered or paid for. These same ledgers also showed a total of $7.6 billion available for new aircraft procurement contracts in 1954.

▶ **Level Stays High**—Actual spending by the Defense Department for military aircraft (out of the $27-billion unexpended balance) is programmed for $9.3 billion in fiscal 1954 ending next June 30 and $9.1 billion for fiscal 1955. This compares with $7.5 billion spent in fiscal 1953 and $5 billion in fiscal 1952. According to Defense Depart-



Weight delivery rate of aircraft in postwar years



Aircraft delivery rate in thousands of planes

ment figures, the aircraft industry will enter fiscal 1956 on July 1, 1956, with a backlog of about $17 billion in military aircraft procurement.

For an industry whose total military sales volume was about 10% of that figure as recently as 1950 this is still a pleasant prospect.

▶ **What's Ahead**—While Defense Department expenditures are the best index of current business in the aircraft industry, the new obligational authority requested for aircraft procurement in each budget offers the best clue of what is likely to happen two and three years hence. By watching new obligational authority for aircraft procurement it is possible to chart a curve sliding downward from the peak of the Korean crisis to the level at which the aircraft industry is likely to settle.

Contracting by the military reached a peak in 1953, when about $12 billion worth of orders were given to the aircraft industry. For fiscal 1954 a total of about $7.7 billion is scheduled for new aircraft contracts, while fiscal 1955 is programmed for $6.5 billion in new military aircraft business.

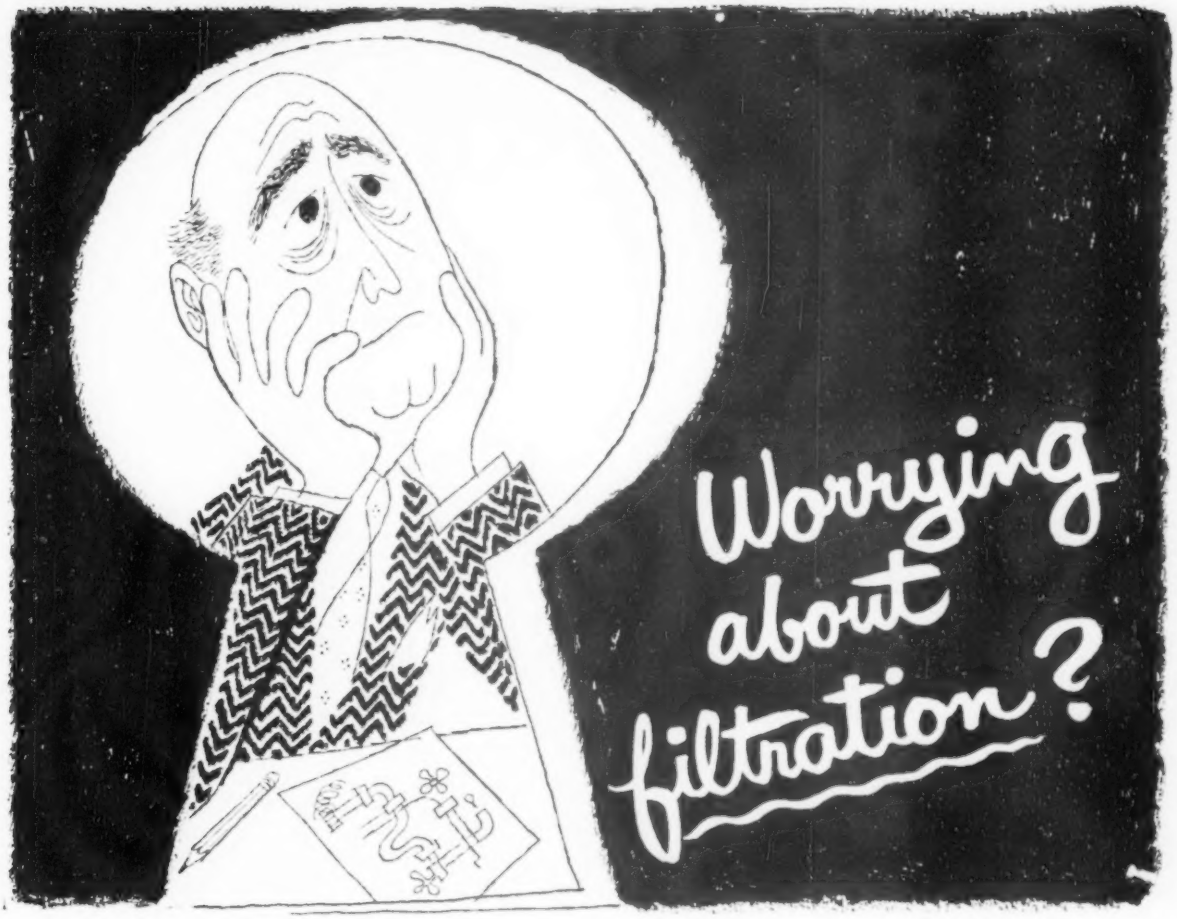
This $6-billion annual aircraft procurement level, plus another billion for missiles and special avionics devices not included in aircraft costs, is about where the aircraft industry will probably emerge in 1956 after the post-Korean buildup. In dollar volume this is about two-thirds of the post-Korean peak but more than three times the level of the pre-Korean industry of 1950.

This $6-to-$7-billion annual level is clearly forecast in the fiscal 1955 budget, because this is the first budget since the Korean war began that is based solely on a maintenance and modernization rate for the aircraft strengths already authorized for the Air Force, Navy, Marines and Army. All of the funds required for the expansion to these strength levels have been provided in previous years' appropriations (fiscal 1951-54).

▶ **5,500 Planes a Year**—Present plans call for financing about 5,500 new planes annually, to be split among the services as follows:

- **USAF**—3,600 planes and about $4 billion.
- **Navy**—1,600 planes and about $2 billion.
- **Army**—About $50 million.

▶ **A Backward Look**—At the end of 1953 the manufacturing industry could look back on a period as hectic as its frantic expansion to meet the demands of World War II. The expansion triggered by the Korean war gave the industry the double burden of expanding military airpower and at the same time modernizing it to meet the technical requirements of the jet era. Looking back it is now possible to measure the im-



Purolator maintains the world's largest specialized filter research and engineering laboratories

. . . always ready to serve you!

Your filter problems—small or large—are always welcome at Purolator's Engineering Department.

If you find that none of the nearly one thousand types of standard Purolator* filters will fill the bill . . . we'll design one especially for you!

But before you decide on a custom-designed unit, you'll want to study the many kinds of Purolators available on order. The large, illustrated Purolator catalogs are yours for the asking. Just mail us the coupon, indicating which ones you wish.

Whether you need one special filter, or a million of a kind . . . your best source is *Purolator!*

*Reg. U. S. Pat. Off.

PUROLATOR PRODUCTS, INC.
Rahway, New Jersey and Toronto, Ontario, Canada
Factory Branch Offices: Chicago, Detroit, Los Angeles

There's a PUROLATOR for every filter need

Lube oil	Air	Foods	Adhesives
Fuel oil	Chemicals	Cosmetics	Inks
Hydraulic Fluid	Pharmaceuticals	Paints	Beverages
Gasoline			

PUROLATOR
WORLD'S FINEST OIL FILTER

Here's the KEY to your filter problems—

Purolator Products, Inc., Rahway, N. J.

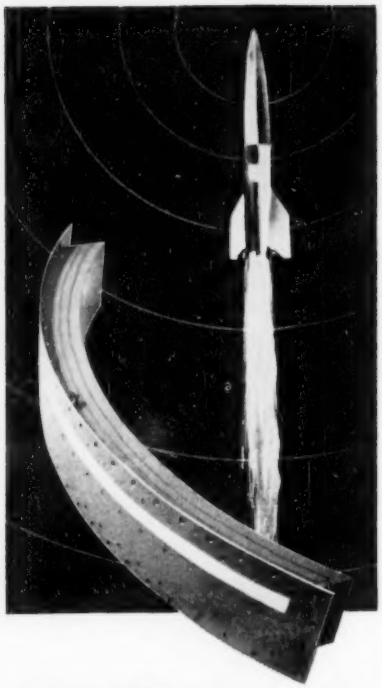
Send the following Purolator catalogs:

☐ Industrial ☐ Aviation ☐ Automotive ☐ Fleet

Name_____ Title_____

Company_____

Address_____



V2 intelligence report

ANSWERS YOUR ANTENNA PROBLEMS

GABRIEL's Flush-mounted Antenna for V2 telemetering was a tough assignment.

Is yours tougher yet?

Are the supersonic speeds, the altitudes, the temperatures higher? Are the G impacts greater? Is intelligence transmission more demanding?

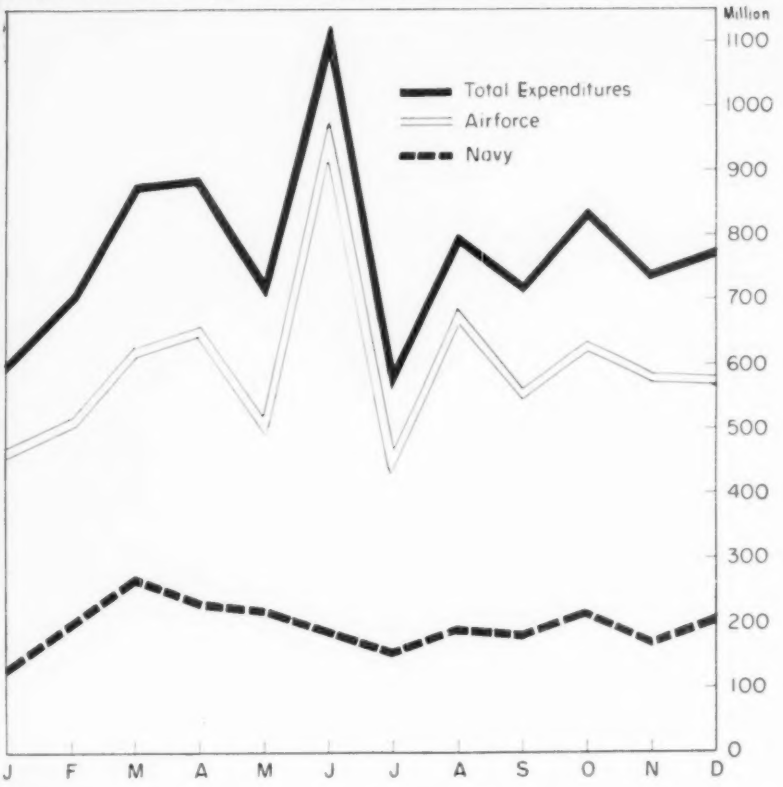
GABRIEL's wide aircraft experience includes every phase of antenna design and large scale production to help you meet the most severe aircraft or missile specifications.

WRITE OR PHONE — A Gabriel Antenna Specialist will consult on your problem when and where you request. NOrwood 7-3300.

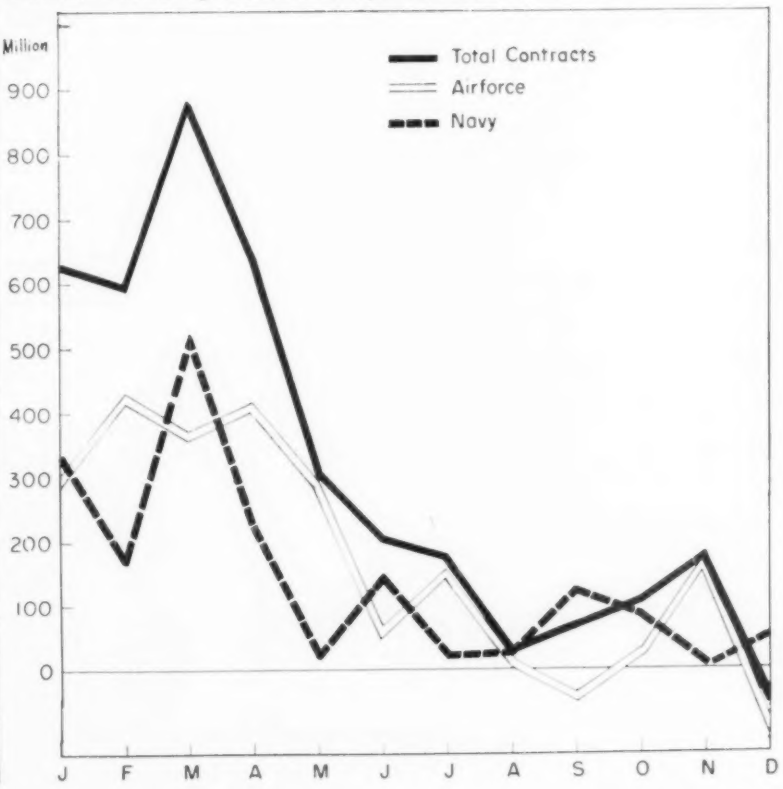
GABRIEL
ELECTRONICS DIVISION

Formerly Workshop Associates Division
The Gabriel Co., 250 Endicott Street, Norwood, Mass.

Expenditures against contracts in 1953



Dollar value of new aircraft contracts in 1953



pact of this dual requirement. Here are some of the things that happened:

• **Production.** Output climbed from a 1950 total of 3,000 planes, most of them piston-powered, to 12,000 planes, over half of them jet-powered in 1953.

• **Employment.** Total employment soared from 257,000 workers in 1950 to 750,000 in 1953.

• **Facilities.** Slightly more than $3.5 billion was invested in new facilities between 1950 and 1953. This compares with $3.8 billion in new facilities during the wartime period 1940-45. During the 1950-53 expansion 34% of the new facilities (about $1.2 billion) were privately financed in contrast to about 10% ($420 million) during the World War II expansion. About 66% of the post-Korean expansion was for tools and production equipment with 34% devoted to new plants.

• **Plants.** Plant area increased from 63 million sq. ft. in 1950 to more than 128 million sq. ft. at the end of 1953.

▶ **New Look**—With the end of actual fighting in Korea and the buildup of production facilities virtually completed it was possible for the incoming Republican Administration to take a new look at the military aircraft production picture and organize a new program aimed at meeting the requirements for maintaining a superior national airpower over a 10-to-20-year period instead of the frantic mobilization to meet the threat of another world war that was expected in 1954.

The new program, designed to unscramble a number of tangles created by the air of urgency in the post-Korean expansion and meet the new airpower doctrine organized by the National Security Council and President Eisenhower, has produced these trends:

• **A further stretchout** in production schedules.

• **Cutbacks** in future orders for obsolescing aircraft types and more emphasis on increased production of newer types.

• **Tighter policy on procurement** of airframe and engine spares.

• **Harder bargaining** on new aircraft procurement contracts.

• **Heavy pressure on industry** to reduce production costs and return to normal production operations.

• **Narrowing the production base** back to the original aircraft industry and elimination of most second-source producers on major airframes and engines.

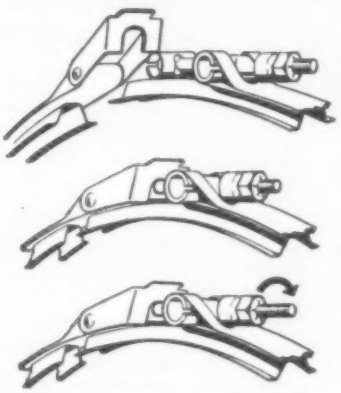
• **Increasing emphasis on technical competition** and proved performance in contrast to "blue-sky" engineering promises.

• **Trend toward development** of complete weapons systems rather than individual items of hardware such as aircraft, armament, maintenance equipment, etc.

Speed up production

with MARMAN *Quick* Coupler Latches

Exclusive Swivel Action... No loose parts...



Quick TO OPEN

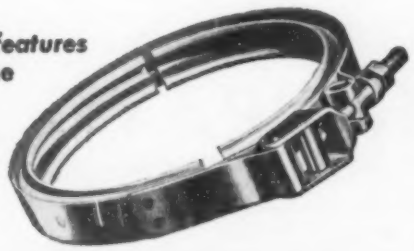
Quick TO CLOSE

Quick TO TIGHTEN

Positive Lock Under All Conditions

Not affected by heat, cold, vibration or stress

These time-saving features **are available on the standard line of Marman precision couplings—easy to specify—fast on delivery**



For catalog or information, write Dept. AW-3-54

MARMAN PRODUCTS CO., Inc.
11214 EXPOSITION BLVD.
LOS ANGELES 64, CALIF.

3-439

SAVE TIME AND MONEY DRAFTING

Don't letter title blocks, specification boxes, symbols, standard components and sub assemblies, standard cross sections . . . in fact, anything that reappears on your drafting board over and over again. Use STANPAT . . . printed on sheets of matte surfaced acetate, backed with a heat resistant adhesive, ready to use in an instant. No special equipment required, just stick 'em down, and there they are.

SEND COUPON FOR

STANPAT

STANPAT • Whitestone 57, N. Y., U.S.A.
Phone: Flushing 9-1693—1611

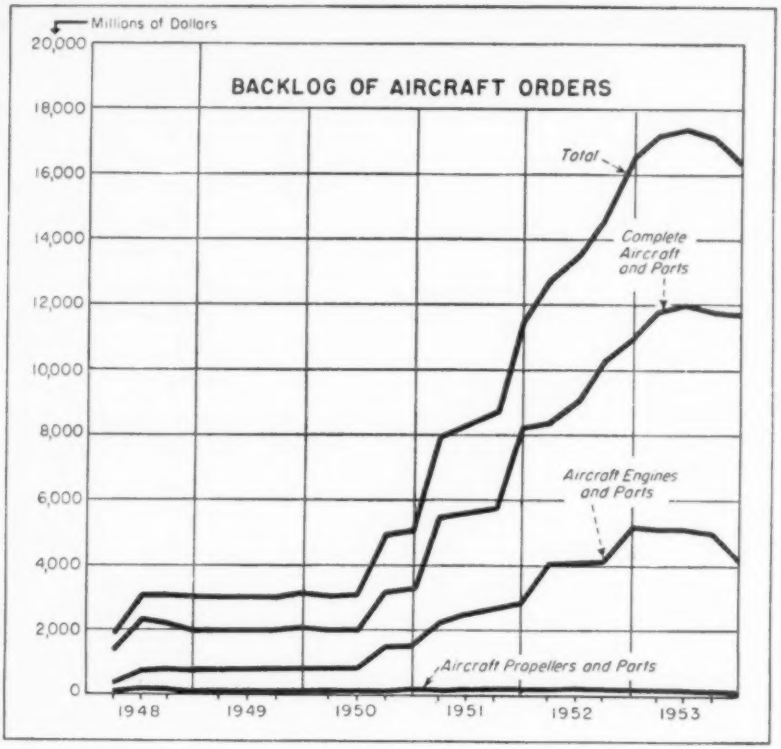
Please send me complete details on STANPAT, with samples and quotations on same.

Name .....

Company .....

Address .....

AW 1



► **Tailored to Fit**—The current stretchout of production schedules has been done on a company-by-company basis tailored to meet each particular firm's problems rather than by universal ukase in the manner of the Truman Administration stretchouts. The aim is to get production schedules on a realistic basis that can be handled by companies with a normal work week and will keep their production and engineering forces occupied until new models phase into the program.

A good example of how this works is the B-47 production program—largest on USAF schedule—at Boeing, Douglas and Lockheed plants in Wichita, Tulsa and Marietta. The B-47 production has been stretched by about 12 months in each plant. This time will permit Boeing-Wichita to phase into B-52 production. Douglas will have time to phase into production on its B-66 bomber at Tulsa, and Lockheed will follow its B-47 with its C-130 turboprop transport.

In each case there will be a minimum loss of production workers between programs. If earlier schedules had been followed, there would have been a gap of about 12 months during which the production forces would have had to be reduced and then rebuilt for the new programs.

This principle has been applied throughout the industry on the basis of information furnished the military by each company on its individual problems. The net result has been to slice a portion off the production peak formerly scheduled and push it forward to fill in the bottom of the valley that loomed after the peak had been passed. This should add a strong element of stability to an industry that has been badly plagued by peak-and-valley production curves.

► **Business Basis**—Another characteristic of the new Pentagon approach to aircraft manufacturers is an attempt to get military procurement back on a hard business basis after the hurried and necessarily wasteful practices of the Korean emergency. Main factors in this trend are:

• **Abandonment of letters of intent** except as an emergency procedure. Both USAF and Navy are still working hard to reduce the tremendous backlog of letters of intent accumulated in 1951 and 1952 when the pressure was heaviest to pour money quickly into aircraft. No letters of intent are being used for new obligations except for emergencies such as modification programs.

• **Return to fixed-price** and incentive target-type contracts. Pentagon is putting the pressure on contractors to negotiate these types of firm contracts before new procurement funds are obligated. This puts both the Pentagon and the contractors in better bargaining positions.

U. S. AIRCRAFT INDUSTRY, 1953

TOTAL EMPLOYMENT (in thousands)

	Aircraft	Acft. Engines & Parts	Props & Parts	Other Acft. Parts & Equipment	Total
January	447.8	158.1	16.3	99.2	721.4
February	448.1	163.7	16.6	100.8	729.2
March	449.2	165.6	16.5	103.7	735.0
April	446.9	159.2	16.5	104.7	727.3
May	445.6	161.3	16.4	105.1	728.4
June	444.5	165.9	16.4	106.8	773.6
July	447.6	167.9	16.3	109.1	740.9
August	453.1	168.2	16.3	112.1	749.7
September	457.7	170.4	16.7	113.4	758.2
October	455.9	172.1	16.5	112.2	756.7
November	430.2	168.4	16.6	111.3	726.5
December*	430.2	168.4	16.6	111.3	726.5

* Estimated.

SOURCE: Bureau of Labor Statistics.

U. S. AIRCRAFT INDUSTRY, 1953

PRODUCTION AND RELATED-WORKER EMPLOYMENT (in thousands)

	Aircraft	Acft. Engines & Parts	Props & Parts	Other Acft. Parts & Equipment	Total
January	326.9	115.0	12.1	76.7	530.7
February	329.3	118.4	12.3	78.1	538.1
March	330.2	119.1	12.3	80.7	542.3
April	327.2	112.6	12.2	80.8	532.8
May	324.8	114.5	12.1	80.9	532.3
June	321.8	118.3	12.1	82.6	534.8
July	322.3	118.9	12.0	83.8	537.0
August	328.1	119.6	11.8	85.8	545.3
September	334.6	121.5	12.2	87.1	555.4
October	331.0	123.4	12.1	86.5	553.0
November	303.3	119.1	12.1	85.5	520.0
December*	303.3	119.1	12.1	85.5	520.0

* Estimated.

NOTE: Figures are for employees involved in or closely connected to actual production operations.

SOURCE: Bureau of Labor Statistics.

U. S. AIRCRAFT INDUSTRY, 1953

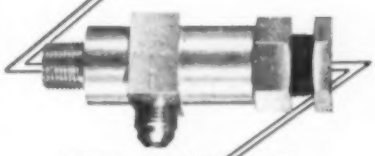
LABOR TURNOVER (per 100 employees)

	AIRCRAFT		AIRCRAFT ENGINES & PARTS	
	Separations	Accessions	Separations	Accessions
January	3.1	3.5	2.9	6.8
February	3.3	3.3	3.1	5.0
March	3.6	3.7	4.2	3.3
April	3.6	3.4	4.0	3.6
May	3.9	3.6	4.3	3.8
June	4.6	5.4	3.5	5.3
July	3.7	4.7	3.5	3.8
August	3.7	4.7	4.1	3.9
September	5.2	4.8	3.8	4.0
October	3.5	3.7	3.9	3.7
November	2.3	3.6	3.7	2.4
December	1.7	2.7	2.0	2.2

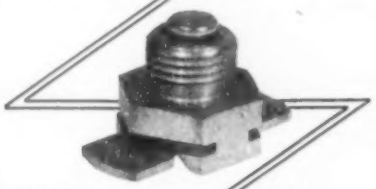
	AIRCRAFT PROPELLERS & PARTS		OTHER AIRCRAFT PARTS & EQUIPMENT	
	Separations	Accessions	Separations	Accessions
January	1.8	5.5	3.8	5.5
February	2.9	2.6	3.2	4.8
March	2.8	3.1	4.2	5.2
April	3.3	2.8	3.9	5.0
May	3.1	2.4	4.0	5.0
June	2.1	3.2	4.1	5.9
July	1.9	2.5	4.3	4.7
August	1.9	2.0	4.5	5.3
September	2.7	2.1	5.5	4.1
October	1.9	2.6	4.4	2.6
November	2.4	2.9	3.5	2.5
December	1.0	.7	3.7	2.9

SOURCE: Bureau of Labor Statistics.

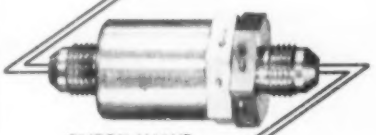
ALLEN AIRCRAFT for reliability



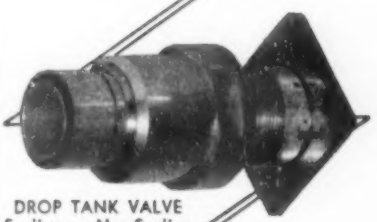
PRESSURE RELIEF VALVE
Metal to Metal Seal



SELF-LOCKING DRAIN VALVE
Straight or Pipe Threads



CHECK VALVE
Poppet Type



DROP TANK VALVE
Sealing or Non-Sealing

Allen's reputation for engineering, designing and producing high quality Aircraft Valves is unexcelled. Write for our latest CATALOGUE or contact one of our authorized representatives today.

WEST COAST: The Thorson Co. Los Angeles, Calif.
SOUTHWEST: Adco Industries, Ft. Worth Tex. and Tulsa, Okla.
MOUNTAIN: Fred Pease, Phoenix, Ariz. and Denver, Colo.
TWX: Ravenna -0-294

Allen Aircraft Products, Inc.
Phone: AXminister 6-6429
P. O. Box 29 Ravenna, Ohio

ELIMINATE HEADACHES!

...in purchasing

VINYL SLEEVING

It's far easier to buy vinyl sleeving from Resin Industries for these important reasons: 1. Meticulous compounding by skilled chemists assures strict adherence to exacting specifications. 2. Precision workmanship. 3. Rigid quality control guarantees uniformity. 4. Prompt and understanding service. No wonder Resinite is the *largest* supplier of vinyl sleeving to the aircraft industry. Write for samples and prices.

Resinite

RESIN INDUSTRIES, INC.

315 Olive St. - Box 1589 - Santa Barbara, Cal.

SPECIALISTS IN VINYL SLEEVING AND TUBING FOR THE AIRCRAFT ELECTRONICS AND MEDICAL FIELDS

Resin Industries, Inc.
Box 1589, Santa Barbara, Calif.
Please send samples and prices of sleeving as follows:

Name_____

Firm_____

Address_____

City_____ Zone____ State_____

U. S. AIRCRAFT INDUSTRY, 1953

AVERAGE HOURLY EARNINGS

	Aircraft	Acft. Engines & Parts	Props & Parts	Other Acft. Parts & Equipment	Total
January	$1.96	$2.04	$2.06	$1.95	$1.98
February	1.96	2.02	2.07	1.96	1.98
March	1.98	2.01	2.01	1.97	1.99
April	1.98	2.00	2.03	1.97	1.98
May	1.97	2.00	2.02	1.96	1.98
June	1.97	2.02	2.06	1.98	1.99
July	1.97	2.03	2.04	1.99	1.99
August	1.99	2.04	2.06	2.00	2.00
September	1.99	2.05	2.05	2.02	2.01
October	2.01	2.06	2.05	2.02	2.02
November	2.02	2.06	2.06	2.02	2.03
December*	2.02	2.06	2.06	2.02	2.03

* Estimated.
SOURCE: Bureau of Labor Statistics.

U. S. AIRCRAFT INDUSTRY, 1953

AVERAGE WEEKLY HOURS

	Aircraft	Acft. Engines & Parts	Props & Parts	Other Acft. Parts & Equipment	Total
January	42.6	45.1	44.7	43.4	43.3
February	42.3	44.3	44.0	43.7	43.0
March	41.5	43.7	41.7	43.8	42.3
April	41.5	42.7	41.3	43.2	42.0
May	41.1	42.9	41.3	42.5	41.7
June	40.7	42.0	41.1	42.3	41.2
July	40.9	42.7	41.5	42.4	41.5
August	41.4	42.6	41.6	42.4	41.8
September	40.7	42.7	41.7	42.1	41.4
October	41.1	42.5	41.3	42.5	41.6
November	41.2	42.1	41.2	42.4	41.6
December*	41.2	42.1	41.2	42.4	41.6

* Estimated.
SOURCE: Bureau of Labor Statistics.

• **Conservative policy on progressive payments.** Pentagon feels that some manufacturers were allowed to build excessive inventories. It will now monitor all future payments of this type to make certain they fall within the strict intent of the law. Progress payments are permissible under USAF contracts. They are specified in Navy contracts, but policy will be more stringent than it has been.

• **Reduction of overtime** operations and subcontracting. Both of these items are expensive and add considerably to aircraft costs.

►**Keener Competition**—Although the aircraft manufacturing industry as a whole will prosper for at least the next two years, the fortunes of individual firms will fluctuate with the quality of their products. The technical revolution that began with the advent of jet power is still in full swing and manufacturers who fail to match its pace with their products will inevitably pay the penalty of falling sales. Never was technical competition keener nor the market for new ideas more bullish in the aircraft business. During the hectic post-Korean months virtually every aircraft in prospect was ordered into quantity production to meet the anticipated major crisis year of 1954.

Now that emphasis has shifted to building airpower for the long pull, the emphasis is on quality first and quantity second. Both USAF and Navy's Bureau of Aeronautics hatched some notable technical turkeys when the emphasis was on quantity at any price and both are now taking a much more conservative technical approach to their new equipment buying. For example, USAF is currently deferring several large procurement obligations for quantity production of particular aircraft until initial flight tests have yielded sufficient technical data to indicate the planes can perform as promised.

It is inevitable that some manufacturers who have done well in the era when virtually everything was being procured will suffer when this technical performance squeeze is applied.

The pace of aircraft development is still moving so fast that companies who are going well today may be far down the gross sales list in another three to

five years. Firms who are still small today but well equipped with aggressive scientific talent well attuned to military requirements may also mushroom with equal speed and move up into the top brackets.

▶ **"Feast or Famine" Problem**—Ever since the sound recommendations of the Presidential Air Policy Commission headed by Thomas K. Finletter dissipated in a political fog during the 1949-50 Democratic economy wave, the aircraft industry has been plumping for a long-range aircraft procurement policy to avoid the "feast and famine" so shockingly demonstrated twice in the last 15 years. The full import of how tremendously expensive this "feast and famine" cycle is in terms of taxpayers' dollars has never been adequately demonstrated either to the taxpayer or the representatives they elected to Congress.

▶ **Six-Prong Attack**—In the meantime the Aircraft Industries Assn. has recommended a specific six-point program to both the government and industry to reduce production lead time and the cost of military aircraft procurement. These points are:

• **New contracting techniques.** Substantial savings on aircraft already in production can be realized if manufacturers are authorized to place advance orders for long-lead-time components.

• **Streamlined approval procedures.** Armed services procurement regulations now require too many essential manufacturers operations to be deferred until they are specifically approved by the military procurement officials. Time required for these approvals varies from a week to three months and increases the cost of the end item and the time necessary to deliver it.

• **Reduce the number of change-orders.** More thorough evaluation of aircraft prototypes would eliminate the need for many change-orders that are issued during the early stages of large-scale production.

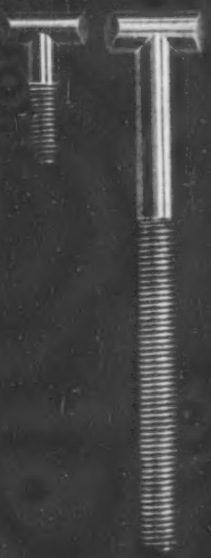
• **Maximum simplicity** commensurate with performance requirements. Efforts toward standardization of certain aircraft parts and components would decrease production time and cut manufacturing costs.

• **Increase production process engineering.** Present regulations limit the amount of money a manufacturer can spend on "process engineering" during execution of a production contract. This limits the development of improved manufacturing techniques that are basic factors in cutting both cost and time.

• **Production stability.** More airpower can be obtained at less cost by a stable production program than by the astronomic funds poured into "crash" programs in order to meet various international crises.

4th dimension of quality

on time delivery

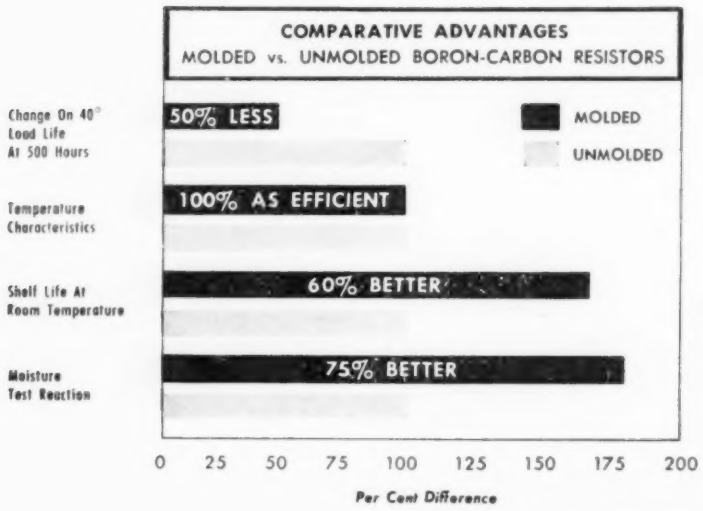


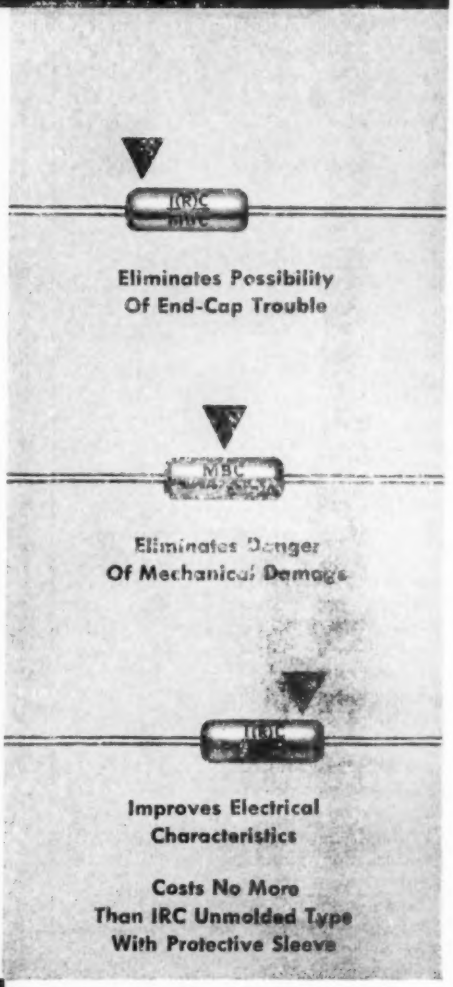
Quality is only as good as the use you can make of it. Cooper craftsmen, long trained in the habit of accuracy, never forget this fact in their efforts to produce "the world's finest" fasteners for aircraft.

COOPER
precision products
5625 WEST CENTURY BOULEVARD
LOS ANGELES 45, CALIFORNIA

NOW
a *molded* boron-carbon resistor

The inherent superiority of a boron-carbon resistor is now available with added advantages of a fully insulated unit. The IRC Type MBC ½ watt, 1% resistor offers significantly better characteristics plus protection against damage during assembly. Send coupon for detailed information.





Whenever the Circuit Says

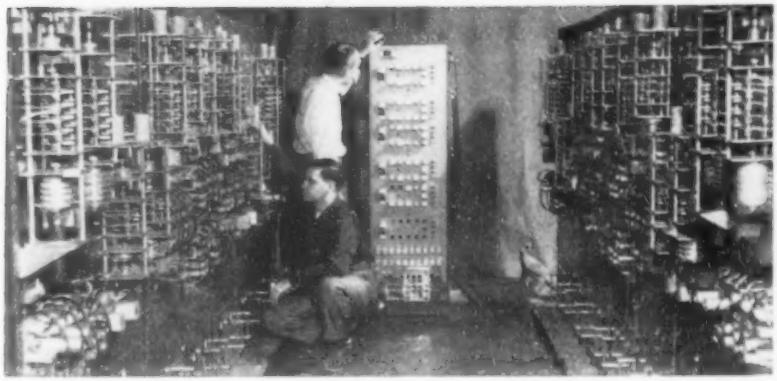
INTERNATIONAL RESISTANCE CO.
Philadelphia 8, Penna.
In Canada:
International Resistance Co., Ltd., Toronto Licensee

IRC

INTERNATIONAL RESISTANCE COMPANY
Dept. F, 401 N. Broad Street, Philadelphia 8, Pa.

Please send Technical Bulletin describing Type MBC resistors:

Name .....
Title .....
Company .....
Address .....
City ..... State .....



SHAPE OF THINGS TO COME in military avionics includes giant closed-loop super systems, typified by Project Volscan traffic control system developed by AF Cambridge Research Center. Photos show ground-based radar (left) and electronic computers (right), used with "data link" for automatic transmission of instructions to aircraft and for controlling their flight paths.

Avionics and Airpower

New Techniques Buttress Avionics' Role

Trend toward giant super systems, coupled with tiny microtronic devices and developments in automation, indicates what's ahead in military avionics.

By Philip Klass

Three major trends in military avionics development, application and manufacturing stand out among the significant advances and disclosures of the past year.

- **Giant super systems,** for air defense, tactical air support, traffic control and landing.
- **Microscopically small construction,** using radically new techniques, to reduce greatly avionic equipment size and weight.
- **Automatic-factory-type** production of avionic equipment.

Super Systems

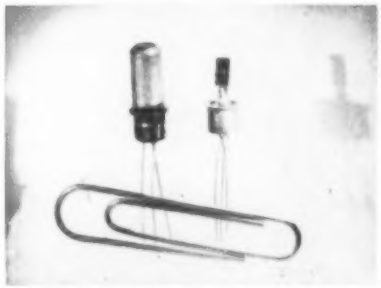
The day of the military pilot flying as a free agent in search of a target of opportunity is fast disappearing. If military aircraft are to carry out their increasingly important role in the national defense, they must be controlled like chessmen from a command headquarters which has up-to-the-instant information on the disposition of enemy air and ground targets, as well as its own aircraft.

▶**Avionics' New Role**—Providing centralized information and control—accurately and precisely—is the important role of avionics in military airpower. This is increasingly true for continental air defense and tactical air support. It is the need for centralized information and control centers that is responsible for the coming era of super systems.

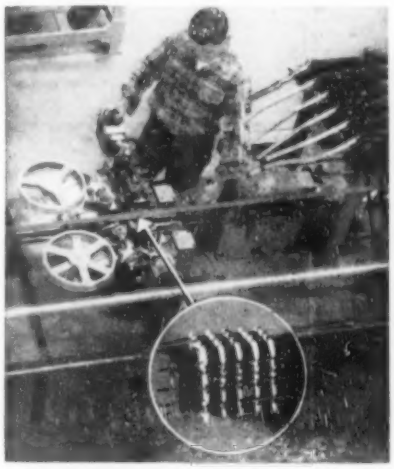
The super systems will employ many radars or other sources of intelligence (either ground-based or airborne), vast communications networks to feed such intelligence into ground-based or airborne control centers, batteries of digital computers to analyze raw data, display boards to picture graphically the tactical situation, and finally, a data link to transmit automatically information to aircraft and control their flight path or point of bomb release.

▶**Systems Under Development**—An increasing portion of our military budget is going into the development and procurement of super systems for air defense and tactical air support. Largest and most complex of these, for continental air defense, are being developed under the AF Cambridge Research Center and Massachusetts Institute of Technology's Lincoln Laboratories. Many avionic manufacturers and several other military establishments and universities are playing prominent roles in the system development.

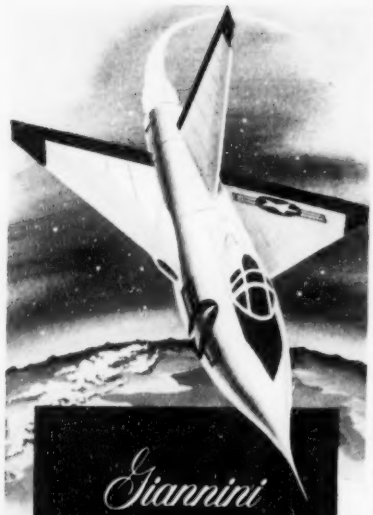
Tactical air control systems, being developed under the Rome Air Development Center, are the first super-system attempt to apply the latest avionic technology to the difficult problem of ground support.



MICROTRONIC construction techniques under development will permit major size and weight reduction in complex airborne equipment. New Philco technique for making transistors is one step.



AUTOMATIC FACTORY for avionics has come faster than expected. Photo shows one step in process at Navy-National Bureau of Standards' pilot plant, now in operation. Signal Corps and USAF also have automation programs.



Giannini
HIGH PRESSURE
TRANSMITTERS

Giannini high pressure transmitters accurately translate pressure into proportional electrical signals of relatively high power, and require little or no amplification.

MODEL 46129

These high pressure transmitters incorporate a unique direct coupling arrangement between bourdon tube and potentiometer element which obtains movement amplification without the use of gearing or linkage, thus giving high sensitivity, repeatability, and low hysteresis.

Ranges from 0-100 psi. to 0-6500 psi., (abs., diff., gage). Instruments are available for operation under either normal or extreme conditions of vibration and acceleration or for corrosive media.

Other models also available for low pressure and high altitude applications. Write for complete engineering information.

MODEL 46139

G. M. GIANNINI & CO., INC.
AIRBORNE INSTRUMENT DIVISION
PASADENA 1, CALIFORNIA

Giannini

■ AVIONICS

In one sense, these TAC systems will be miniature air defense systems designed to protect tactical areas from enemy air attack. However, they must also provide for ground support operations and be designed for maximum mobility and quick setup, requirements that are not imposed for continental air defense.

► **Super System Forerunner**—Several months ago, USAF's Air Research & Development Command took the security wraps off Project Volscan, a nearly automatic traffic control system developed by its Cambridge Research Center (AVIATION WEEK Dec. 28, 1953, p. 38). It provides a look at the nature of the super systems to come.

Volscan's specific mission is to convert a cloud of randomly arriving jet aircraft, returning to base with near-empty fuel tanks, into an orderly stream so that each plane arrives in proper close-order sequence without delays at low altitudes where fuel consumption goes up by a factor of three.

Volscan consists of:

• **Search radar,** which spots all aircraft returning to an airdrome.

• **Automatic trackers** (Antracs), which isolate and track individual aircraft blips, thereby converting a search radar into many tracking radars.

• **Schedule computer,** which calculates earliest, non-conflicting time of arrival for each aircraft.

• **Flight path computers,** which calculate flight path each plane must fly to arrive at scheduled time and provide continuous signals indicating required airplane heading and altitude.

When Volscan was demonstrated to the press, the flight path computer instructions were relayed by human operators over voice radio. The next step, which has already been tried experimentally, is to employ a radio "data link" which automatically transmits individual flight path computer instructions to the appropriate aircraft's instrument panel or its automatic pilot. In the latter case, the flight path computer will automatically maneuver the airplane onto the required flight path by means of its automatic pilot, fully closing the ground-to-air loop.

► **Closed-Loop Systems**—From a functional standpoint, a closed-loop Volscan operating through a data link shows the pattern of future super systems. The problem which Volscan solves is admittedly less difficult than trying to vector interceptors to fast-moving targets, or accurately pinpointing frontline ground targets.

From the standpoint of techniques, the TAC and ADC systems may employ digital computers instead of the analog types used throughout Volscan.

► **New Digital Computer Role**—The growth of super systems has created an important new role for large electronic digital computers, which may easily overshadow their first use as extremely highspeed versions of conventional calculating machines.

This is the application to "real-time" problems, such as traffic control, fire control, missile guidance, and air defense, which were previously in the exclusive domain of analog computers.

(The terminology of "digital" and "analog," widely used to distinguish between the two types of computers, is somewhat ambiguous, since digital computers function as analog devices when solving real-time problems. Despite this, the terminology will be used here for lack of better names.)

A real-time problem is one in which the computer receives essentially continuous data on the parameters of an ever-changing problem from which it calculates continuously an up-to-the-instant solution. For example, a radar might supply a computer with information on the bearing, height, and distance of enemy bombers and our own fighters, from which the machine would compute continuously the required interceptor heading and rate of climb.

► **Must Be Speedy**—To solve real-time problems, digital computers must be extremely fast, have suitable storage registers to hold changing input-output data momentarily. One machine with such capabilities is the 4,500-tube ERA 1103, developed by Engineering Research Associates Division of Remington-Rand for undisclosed use by the Defense Dept. (AVIATION WEEK May 11, p. 67). Rem-Rand says the machine can perform 14,000 additions per second, 4,000 multiplications per second.

More recently, two real-time computers which are small enough for use in large aircraft have been announced by Jacobs Instrument Co. (AVIATION WEEK Feb. 1, p. 45). The smaller of the two is capable of handling nine variable inputs, providing three variable outputs.

All major digital computer manufacturers are believed to be working on airborne or ground-based real-time computers for defense needs, in addition to the general-purpose machines which are playing increasingly important and useful roles in the aircraft, avionic, and other industries.

► **Digital Communication**—The vast communication networks which form the lifestream of the super systems impose new demands on a radio spectrum already bulging at the seams.

Information-theory developed in recent years shows that voice communication using conventional amplitude modulation is extremely wasteful of spectrum bandwidth. By converting speech into coded pulses (called "digital communication") for transmission, in-

Facts about *HELI-COIL* inserts in the aircraft industry

What they are

*Heli-Coil** screw thread inserts are precision-formed coils of stainless steel or phosphor bronze wire. Wound into tapped holes, they form permanent non-corrosive, strip-proof threads of astonishing strength.

How they cut weight

Threads tapped in aluminum or magnesium when protected by *Heli-Coil* inserts are much stronger, therefore you can use smaller, fewer, shorter cap screws for required strength. Fewer or shorter cap screws mean savings in fastening-weight, through lighter bosses, thinner flanges, and thinner wall sections.

What they are for

AS ORIGINAL COMPONENTS: *Heli-Coil* inserts are used to provide stronger, lighter fastenings, corrosion-proof, wear-proof, threads in all assemblies. Thus you find *Heli-Coil* inserts throughout aircraft engines, airframes, and accessories, from the heart of jet engines to skin inspection panels.

FOR PRODUCTION SALVAGE: When conventional tapped holes are damaged in production, restore them on the line with *Heli-Coil* inserts. Get better-than-original strength with no increase in screw size and no tell-tale signs of rework.

FOR SPEEDY REPAIRS: When tapped threads are fouled up by wear, stripping, or corrosion in service, renew them in minutes on location in shop or field with *Heli-Coil* inserts.

No welding—no plugging—no secondary machining—no oversize screws.

For useful tips, use the coupon for free subscription to *"Heli-Coil"* in which we publish latest news on what others are doing in your field.

How they work

Holes are drilled and tapped as you do for ordinary threads—then *Heli-Coil* inserts are wound into tapped holes by hand or power tools. Install in a few seconds, assure thread protection forever. Can be used in any metal, wood or plastic.

No other method is so simple, effective and practical.

Heli-Coil inserts improve the end product, cut rejects, salvage threading errors.

All sizes and types

Available for National Coarse, National Fine and Unified threads, pipe threads and spark plug threads. They are made in all standard sizes and lengths for assemblies requiring Class 3, 3B, 2 or 2B fits.

Best time to put *Heli-Coil* inserts benefits to your use is right at the designing board, as many leading manufacturers are doing. But to convince you of their many advantages ask for a working demonstration right on your production line. Write today! Complete information and engineering data is available in the *Heli-Coil* catalog. Use coupon!

*Reg. U. S. Pat. Off.

Approved for All Military and Industrial Uses

Here's one way you can ease the pain of cutting costs:

Learn the economies possible only with ***Heli-Coil*** Screw Thread Inserts.

Here are a few of them—

They enable you to use fewer or smaller fastenings by increasing the strength of each threaded assembly.

They enable you to use lower-cost fastening methods—for example, cap screws instead of nut-and-bolt or stud-and-nut assemblies.

They eliminate thread failures and thereby cut service costs in products which have to be regularly dis-assembled and re-assembled.

They enable you to use lower-cost materials without any fear whatever of thread failure.

They enable you to reduce weight and miniaturize.

Every one of these facts about ***Heli-Coil*** Inserts has been *proved* by their increasing successful use in airframes, engines, electrical and electronic equipment, accessories, guided missiles.

The coupon will bring you all the facts and, if you like, a ***Heli-Coil*** *Engineer can help you fit them to your austerity problem to make that austerity easier. No obligation, naturally.*

*Reg. U. S. Pat. Off.

HELI-COIL CORPORATION

423 SHELTER ROCK LANE, DANBURY, CONN.

☐ Please send Bulletin 689, Military Standards Sheets.

☐ Please have a *Heli-Coil* Thread Engineer call.

☐ Please send information on *Heli-Coil* Insert Applications in the Aviation Industry.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

more and more leading airlines agree . . .

the finest airline seats are TECO-built!

Many major airline demands for comfortable, lightweight, ruggedly built, low maintenance airline seats have been successfully met by Transport Equipment Company.

Among these, the three leading airlines appearing here wanted TECO's outstanding engineering, original styling, lightweight construction and passenger comfort to be combined with their own individual requirements.

TECO ability to beat the problems and deliver on time, to complete customer satisfaction, is the reason more and more leading airlines agree the finest airline seats are TECO-built! To solve your passenger seating problems—specify TECO, the airline seat that gives you Custom Quality at production line economies!

EASTERN AIR LINES selects TECO model TE-317 standard size seats.

TRANS-CANADA AIRLINES equipped with TECO TE-316 standard size airline seats.

TRANS WORLD AIRLINES luxury seat-berth choice is TECO model TE-304 berthable and TE-305 reversible combination.

TECO INC.

For complete information on TECO hi-density, luxury, folding, reversible and berthable seats, and TECO's new light weight upper berth—write: Engineering Dept., 2501 No. Ontario Street, Burbank, Calif.

2501 NORTH ONTARIO STREET • BURBANK, CALIFORNIA

dividual channel bandwidth can be compressed from 3,000 cps. to 100 cps. or less. This means that 30 times as many channels can be provided within the same band.

There are a variety of ways in which speech can be pulse-coded. The AF Cambridge Research Center is digging deeply into the subject to devise a versatile system in which spoken words can be pulse-coded and then decoded automatically into printed words.

If successful, a command spoken at an air defense center would appear instantly as a printed message in remote air defense centers and in teletype-equipped aircraft. (An airborne teletypewriter under development by the Wright Air Development Center is expected to weigh less than 50 lb. including tape cutter and transcriber.) All words will be spelled phonetically, i.e., "fonetikly."

Meanwhile, work on less sophisticated forms of digital communication is being sponsored by the Rome Air Development Center. One of its contractors, Melpar, Inc., has developed a speech synthesizer which constructs intelligible speech from a pulse code having a bandwidth of only 75 cycles.

▶ **Pulse-Coding Advantages**—The ability to transmit oral commands instantly to far-flung sites in the form of printed instructions can prevent misunderstanding, save precious minutes in the event of an enemy attack.

In addition to convenience, speed, and reduced bandwidth requirements, there is another important advantage: Pulse-coded messages can be scrambled in a wider variety of ways than is possible with present communications systems to prevent an enemy from deciphering them.

▶ **Data Link**—Several systems of transmitting information (not voice) by pulse-code modulation are presently under development or test at AFCRC, Rome Air Development Center, and in the Navy. The advantages of pulse-coded transmission of command and control information, called "data-link," are reduced bandwidth (or reduced transmission time) and the ability to operate with a poorer signal-to-noise ratio.

Data link is intended to enable tactical and air defense centers to control the flight path or bomb release point of individual aircraft via its automatic pilot. Data link will also be used to flash command instructions to pilots on a special cockpit instrument.

▶ **Handling Super Systems**—Advent of super systems has forced organizations like RADC, AFCRC, and some manufacturers, to set up groups whose sole task is to supervise and coordinate development of the many complex subsystems which make up a super system.

For example, RADC has created a 100-man systems division to assure subsystem compatibility and the tactical usefulness of its super systems.

AFCRC set up a separate systems project section after it found that its important research efforts were being diverted to systems work. Cambridge has now divided its electronics division roughly in half, with one group devoted to systems work, the other to research and component development.

▶**Tough Assignment**—Finding engineers with a sufficiently broad background for super-systems work is difficult. They need experience in radar, communications, computers, flight control, and tactics.

However, "it is in systems engineering . . . that the real challenge to young engineers lies," R. J. Nordlund of WADC's armament lab has said. Nordlund calls it "the most broadening of any phase of the profession."

Microtronics

If avionic systems are getting larger, the basic electronic building blocks are getting smaller, as well they must, particularly for airborne use. There is increased emphasis on developing radically new components and construction techniques which are microscopically small, compared with the best previous sub-miniature techniques. AFCRC, which is sponsoring some of the work in this field, calls it "Microtronics."

▶**Triggered by Transistors**—The transistor, tiny vacuum-tube replacement invented six years ago by Bell Telephone Labs, triggered the microtronic movement, both with its own capabilities and by stimulating interest and research in the semi-conductor field.

At first blush, the transistor's potential advantages of small size, light weight, low power consumption-heat dissipation, long life, made it appear to be the answer to the avionic engineer's prayer. But even after transistor manufacturers had learned, the hard way, that hermetic or improved sealing was needed for long trouble-free transistor life, there proved to be several other limitations to its use in avionics:

- **Low operating temperature.** Germanium transistors were generally limited to operation at temperatures below 70C; practically all avionic equipment must be designed to operate in ambient temperatures of 85C, frequently higher.
- **Low frequency.** Except for experimental four-element (tetrode) transistors, the device could be used only at frequencies up to a few megacycles, greatly limiting its radio-frequency applications.
- **Low power rating.** Maximum power rating of production transistors was in the order of a few tenths of a watt.
- **Limited availability.** Because of lab-

The Heart
of AIRCRAFT CONTROL SYSTEMS

SERVOmechaNISMS INC.
brings years of experience
to your specific requirements in
centralized air data computation. There
is no limit to the number of outputs
—the number of functions computed
—or the number of services
these computers can be
designed to perform.

SERVOmechaNISMS INC.
PACKAGED FUNCTIONAL COMPONENTS

Visit us at the
New York I. R. E. Show,
March 22-25
Booth 740-742.

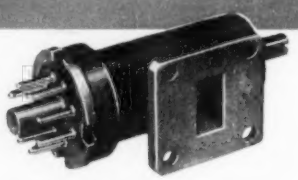
Designed and Produced at El Segundo, California
and Westbury, New York

Klystron Tubes and

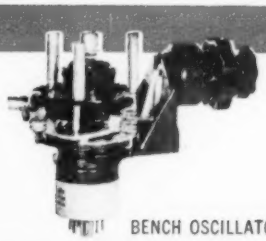
WIDE RANGE REFLECTS 16 YEARS OF EXPERIENCE IN MICROWAVE FIELD

KLYSTRONS

Frequency Range from 750 megacycles to 26,000 megacycles.

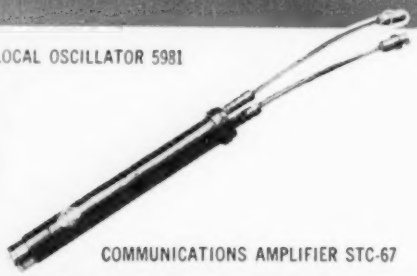


LOCAL OSCILLATOR SRU-55

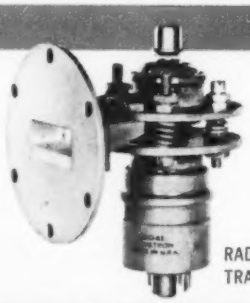


BENCH OSCILLATOR 2K41

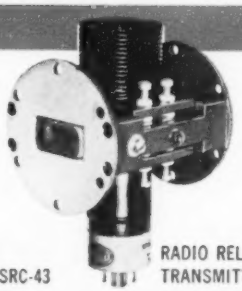
LOCAL OSCILLATOR 5981



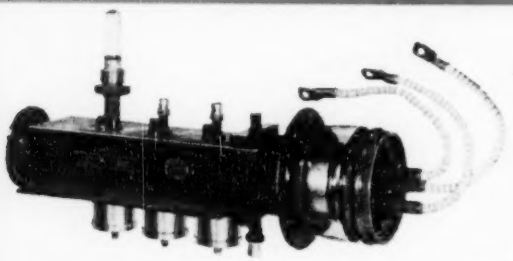
COMMUNICATIONS AMPLIFIER STC-67



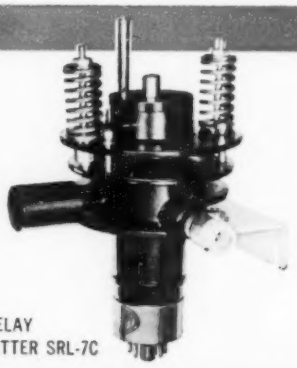
RADIO RELAY TRANSMITTER SRC-43



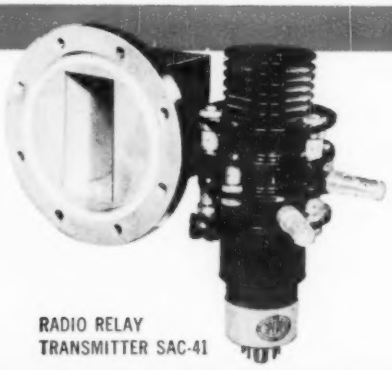
RADIO RELAY TRANSMITTER SAC-19



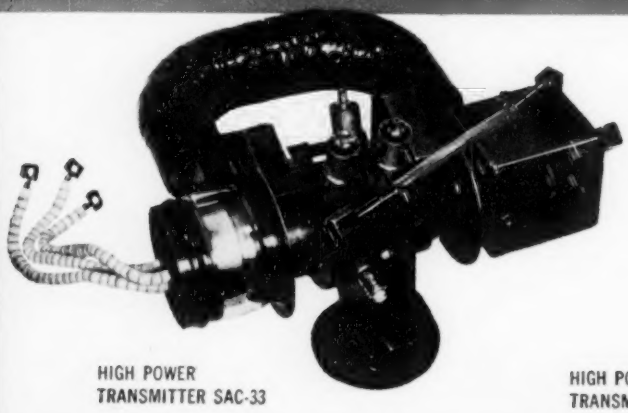
HIGH POWER TRANSMITTER SAS-28



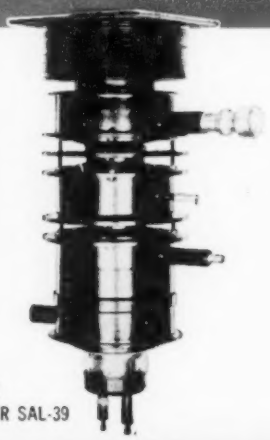
RADIO RELAY TRANSMITTER SRL-7C



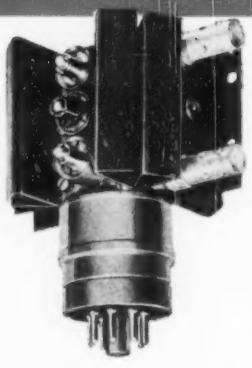
RADIO RELAY TRANSMITTER SAC-41



HIGH POWER TRANSMITTER SAC-33



HIGH POWER TRANSMITTER SAL-39



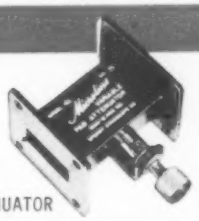
HIGH POWER TRANSMITTER SAC-9

*Microline** Instruments

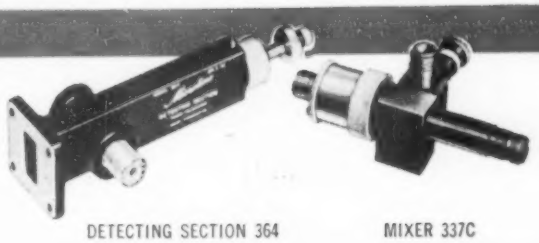
Since 1938, when Sperry sponsored the development of the Klystron, this company has extended its application to tubes for low, medium and high-power applications. As a pioneer in microwave measuring techniques, Sperry has developed Microline instruments which include every type of device essential to precise measurement in the entire microwave field. Research and development are continuous at Sperry and the results are always available to you.

*T.M. REG. U.S. PAT. OFF.

*Microline** Test equipment covering 500 megacycles to 40,000 megacycles in 7/8 inch coaxial line and 8 waveguide sizes.

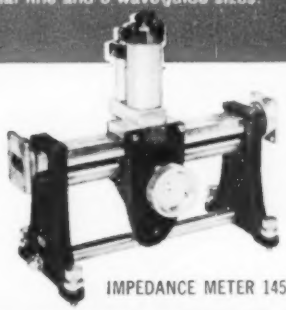


ATTENUATOR 152A

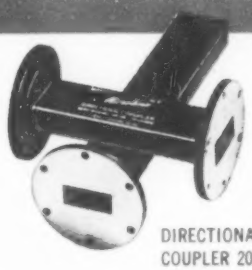


DETECTING SECTION 364

MIXER 337C

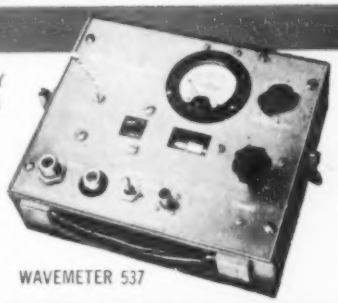


IMPEDANCE METER 145



DIRECTIONAL COUPLER 209

FREQUENCY METER 28B



WAVEMETER 537

RADAR RANGE CALIBRATOR UPM-11

VSWR TEST SET 539

RADAR TEST SET 38A

KLYSTRON POWER SUPPLY 555

On these pages, only one item in each product line is illustrated. Also included in the Sperry line, but not illustrated, are the following additional Microline instruments: Barretter and Thermistor Mounts, Barretter Elements, Impedance Transformers, Terminations, Adapters, Wattmeter Bridges and Adjustable Shorts. For complete details write our nearest district office.

SPERRY GYROSCOPE COMPANY

DIVISION OF THE SPERRY CORPORATION
Great Neck, New York

Cleveland • New Orleans • Brooklyn • Los Angeles • San Francisco • Seattle
In Canada—Sperry Gyroscope Co., Limited, Montreal, Quebec

RAPID
ACCURATE
PRODUCTION

Axelson aircraft components, including landing gear shock struts, gears, geared mechanisms, segments, spars, braces and other plane structural parts, are serving throughout the world in both military and commercial planes. Axelson's facilities are among the largest and most modern; it is staffed with competent engineers and master craftsmen. If you have work involving precision aircraft production, we invite your inquiry and personal inspection.

Write for Facilities Booklet 5037.

AXELSON
MANUFACTURING COMPANY DIVISION
P.O. BOX 1033S, VERNON STATION, LOS ANGELES 58
PRESSED STEEL CAR COMPANY, INC.

LOS ANGELES PLANT
MONTEBELLO PLANT

■ AVIONICS

oratory-type manufacturing techniques —including assembly under a microscope—transistor makers had trouble producing sizable quantities of improved units with sufficiently uniform characteristics.

▶ **Significant Development**—One of the most significant transistor developments of the past year came several months ago when Philco Corp. disclosed a radically new manufacturing technique which holds promise of easing many previous limitations (AVIATION WEEK, Jan. 4, p. 50). Philco has

SURFACE-BARRIER technique developed by Philco for making transistors by using tiny streams of liquid is step toward microtronic construction.

introduced two innovations with its "surface barrier" technique:

• **Fluid jet etch.** Two tiny streams of etching solution are simultaneously directed coaxially against opposite sides of a small pellet on semi-conductor material, with a potential of several hundred volts between the jets and the pellet. In less than two minutes, the jets have etched two pits in the pellet leaving a thin bridge of semi-conductor material only 0.0002 in. thick.

• **Electroplated junctions.** When the bridge has been cut to the required thickness, the voltage polarity is reversed and metal ions from the jets are electroplated into the pits. By using suitable metallic salts for the etching fluid, a rectifier-type contact is made between the deposited metal and the semi-conductor pellet, giving transistor action.

▶ **Better Transistors Result**—Despite limited experience with its new process, Philco has achieved the following:

• **Higher-frequency operation,** with alpha cut-off frequency consistently higher than 50 mc., occasionally higher than 100 mc.

• **Low voltage-power.** New unit operates with collector voltage only one-third to one-fifth as large, and uses only one-tenth to one-twenty-fifth as much power as point-contact and tetrode transistors with comparable frequency response, Philco reports.

AVIATION WEEK inquiries indicate that the transistor industry is impressed with the new Philco technique, particularly its jet-etch approach to transistor fabrication. Here is what they like about the process:

• **Easily controlled.** The entire process is simple, easily controlled, indicating that the surface-barrier process can easily be adapted to automatic production machinery.

• **Precise dimensions.** Process makes it possible to fabricate transistors with a very thin bridge of semi-conductor between collector and emitter. This gives device a high frequency response, enables it to operate with low voltage.

• **No contamination.** The jet streams continuously wash away the molecular sawdust produced during the process and keep pellet surface free of contamination until after the emitter and collector junctions have been formed.

• **No structural damage.** The etching process operates only on top-layer atoms, preventing damage to pellets' all-important mono-crystalline structure.

▶ **High-Temp Transistors**—More recently Philco has disclosed that it has made experimental surface-barrier transistors of silicon, which can operate at temperatures of 150-300C. Philco reports these experimental silicon transistors have amplification factors (alpha) greater than 0.95 (some as high as 0.995), and alpha cut-off frequencies higher than 10 mc.

On the heels of this disclosure comes an announcement that Raytheon Mfg. Co. has developed and is testing silicon transistors. The company says that present units have been operated at 175C, but emphasizes that there is much work to be done before it will be in production on silicon transistors.

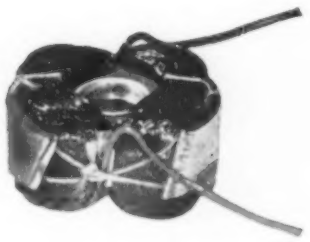
One of the most serious obstacles is lack of quantity production of silicon with required degree of purity. Du Pont and others are working on new refining processes for silicon. Present price tag on transistor-pure silicon is $430 per pound.

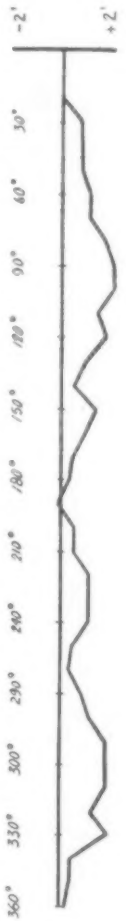
▶ **Other Semi-Conductor Developments**—Some of the other noteworthy developments in the field of semi-conductors during the past year include:

• **High-power transistors.** Minneapolis-Honeywell recently disclosed that it has developed an experimental power transistor rated at 20 watts. General Electric is currently testing an experimental liquid-cooled junction power transistor rated at 100 watts. Transistor Products, Inc. says it is producing junction transistors rated at two watts out-

High Accuracy Synchro for Gyro Pick Off

(Type SG-17-1-A)





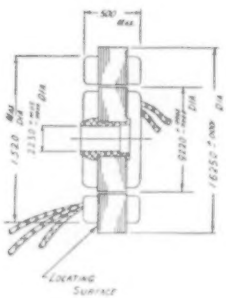
As quantity producers of precision synchros we offer these specially designed interchangeable rotors and stators for gimbal mounting in gyroscopic instruments.

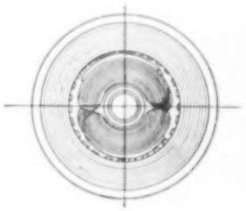
Errors in the finished instrument of less than 6 minutes are obtainable as a production operation with comfortable working tolerances. (The calibration chart in this advertisement shows an error spread of less than 3 minutes.)

Our new plant, built to produce 15,000 synchros monthly, now has open capacity which assures prompt delivery of these synchros if required.

Write or phone A. E. Hayes, Sales Mgr., for full information.

Telephone: MAdison 6-2101 (Suburban Philadelphia)





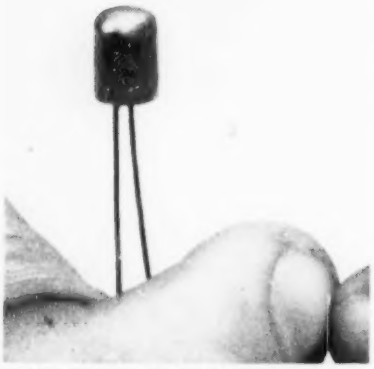
cpc

CLIFTON PRECISION PRODUCTS COMPANY INC.

CLIFTON HEIGHTS — PENNSYLVANIA

put power, in Class B amplifier circuits.

• **Silicon diodes.** Last fall, Bell Labs announced the development of a silicon alloy diode with a back-to-forward resistance ratio approximately 1,000 times higher than for existing germanium diodes, able to operate at 200C temperatures. More recently AVIATION WEEK learned that Hughes Aircraft is now in production on silicon diodes, making it possibly the nation's first mass producer. General Electric is reported to be well advanced in its silicon diode development.



SILICON SEMI-CONDUCTORS, such as this Bell Telephone Labs diode, have high-temperature capabilities previous germanium semi-conductors lacked. This will permit airborne avionics uses previously impossible.

• **Transistor photocell.** General Electric recently announced a p-n junction transistor photocell which is extremely sensitive, particularly to infrared radiation, making it attractive for use in missiles designed to seek out heat-radiating targets. Output from new experimental photocell is large enough to operate a relay directly, without intermediate amplification, GE says.

► **Transistors Too Big**—Although transistors are small, compared to their vacuum tube counterparts, the germanium or silicon pellet which forms the heart of the device is only a tiny portion of the total volume occupied by a present-day transistor. The leads, base, supports, and other paraphernalia add up to several times the volume of the transistor element itself.

In coded-pulse voice communication, a large number of extremely selective filters are needed, and transistors make attractive active-element filters.

Digital computers and devices require vast arrays of transistor flip-flops and diodes. For some contemplated airborne equipments, size and weight still would be prohibitive, even if completely transistorized with present size units.

► **Microtronic Construction**—That's why AFCRC has set up a microtronics group to study and sponsor the development of radically new processes for creating large arrays of transistors and diodes, and their necessary interconnections. By depositing successive layers of germanium (and impurities) on a small postage-stamp size card which has razor-thin interconnecting conductors engraved on it, AFCRC hopes eventually to construct a 1,000-element transistor-diode matrix in a volume of 0.5 cu. in.

AFCRC is sponsoring research programs at Battelle and the Mellon Memorial Research Institutes, aimed at new microtronic basic techniques for fabricating or "growing" all types of electronic components and circuits.

Speaking before the Radio Technical Commission for Aeronautics, Dr. W. R. G. Baker, GE's vice president in charge of its electronics division, said: "It may be possible, in effect, to grow capacitors, resistors, as well as transistors into a single crystal."

It is reasonable to assume that Baker's own division is investigating this possibility and that some report of progress could come within the next year.

By focusing attention on the new field of semi-conductors, the transistor has opened up vast new areas for exploration.

It is not thought inconceivable that a complete semi-conductor amplifier or flip-flop stage could be grown, no larger than present-day transistor pellets. This, if and when it comes, will complete the revolution in electronic construction techniques which is already under way.

Automation

Until recently, electronic equipment fabrication seemed to defy automation. A typical equipment consisted of hundreds of different-sized and -shaped components, laid out in a functional, but hodge-podge manner, with a rat's nest of interconnecting wires.

Among military equipments, electronics had the highest percentage of hand labor, except possibly for some precision instruments. This fact, when viewed in the light of vastly increased military use of electronic gear, sent shivers down the spines of military mobilization planners.

After the war, Britain's Sargrove Electronics Ltd. constructed a machine which could turn out 500,000 two-tube radio chassis a year automatically except for manual installation of the speaker, power transformer and tubes. Needing a production run of 20-100,000 sets to justify its construction and tooling cost, no more machines were built after the vast Asian market disappeared behind the Iron Curtain.

► **Printed Circuitry**—In this country, the military services and industry moved more cautiously after the war.

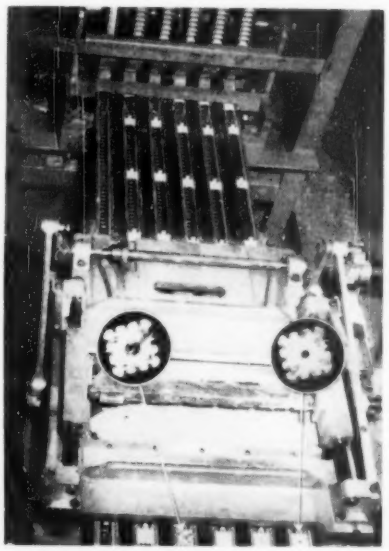
The Signal Corps and others pushed the technique of using printed circuitry and dip-soldering. Most of the interconnecting wires were etched or printed on a fiber board, appropriately located holes were drilled or punched, component leads were inserted by hand in these holes, and the entire assembly dipped in a solder bath to secure and connect the components.

Today this technique is a widely used time-saver in medium or large production runs of both civilian and military equipment.

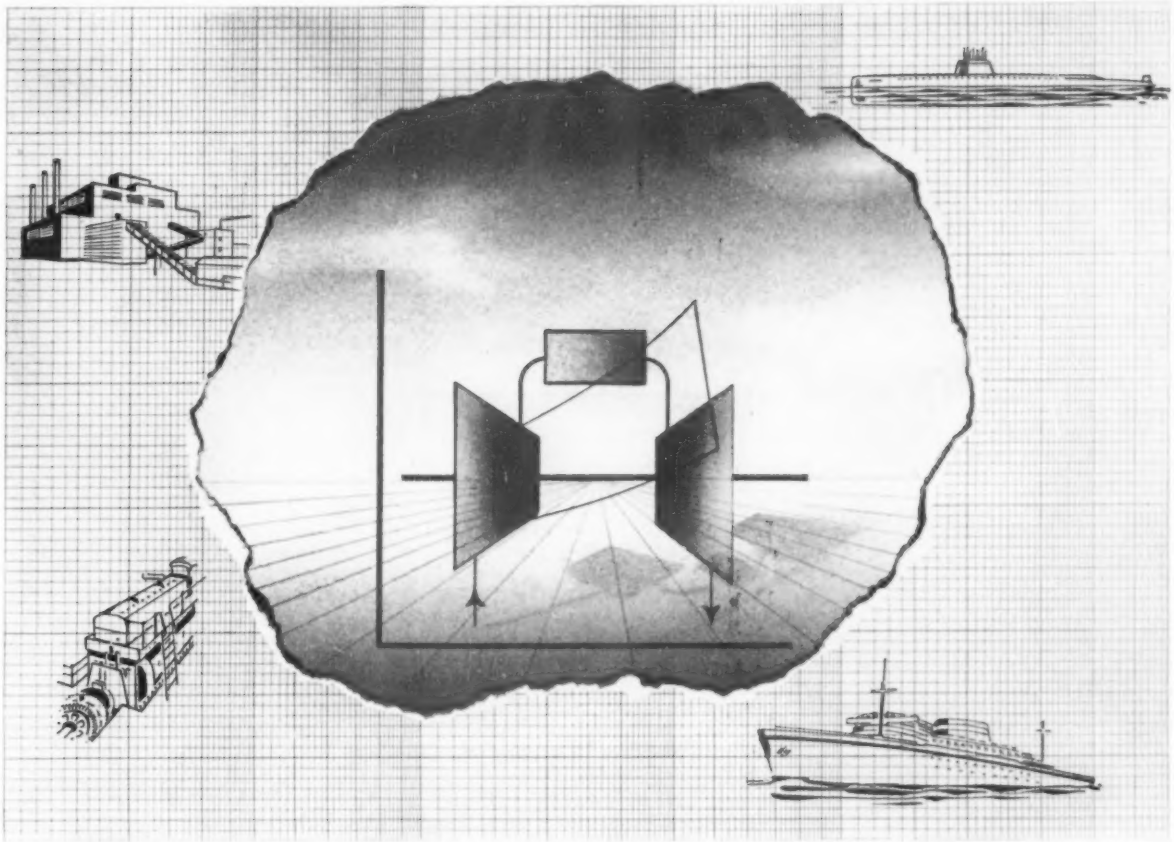
About two years ago, the Signal Corps contracted with GE to develop a machine which could automatically place conventional components in printed circuit boards, acting under instructions from a magnetic tape or punch card. This program is expected to eliminate the major remaining hand operation. GE is also developing associated machines to test components, cut and form their leads, and transport them to the component placement machine. This program, first reported in AVIATION WEEK (Nov. 17, 1952, p. 36), is slated for completion by mid-1955.

Meanwhile the Air Force had launched a study-development contract for automation of avionic equipment construction at the Stanford Research Institute.

► **Navy Bombshell**—Very little had been heard from the Navy, until last fall when the Bureau of Aeronautics dropped a bombshell by announcing



NAVY-NBS PILOT PLANT turns out variety of small avionic modules almost completely automatically. This machine silver-paints conductor patterns on six ceramic wafers at one time.



What has this symbol to do with *the future of power?*

Plenty. You'll recognize this symbol as a conventional thermodynamic cycle. But there's nothing conventional in the new developments in thermodynamics at I-T-E. These revolutionary developments may well usher in new horizons in the field of power generation.

Development work in thermodynamics is only one of the many projects on which the Special Products Division of I-T-E is engaged. Other challenging assignments include development and fabrication of a number of close-tolerance devices for extreme service conditions.

Whether your problem is new development to performance specifications, or fabrication with new and hard-to-work alloys, you'll want to know how this unique organization can help you.

Send for Publication SP-100 A 3 today.

RADAR ANTENNA SYSTEMS
design, development and fabrication

JET ENGINES
manufacture of major hot-end components

THERMODYNAMICS
design, development and fabrication of equipment to operate on advanced theories

GUIDED MISSILES
advanced fabricating techniques

TITANIUM
proven welding, forging, forming, spinning techniques with this hard-to-work metal

SPINNING
combining spinning and drawing to an almost limitless variety of designs in a wide range of metals

TECHNOLOGY
ABILITY
FACILITIES

SPECIAL PRODUCTS DIVISION

I-T-E CIRCUIT BREAKER COMPANY

601 E. Erie Avenue • Philadelphia 34, Pa.

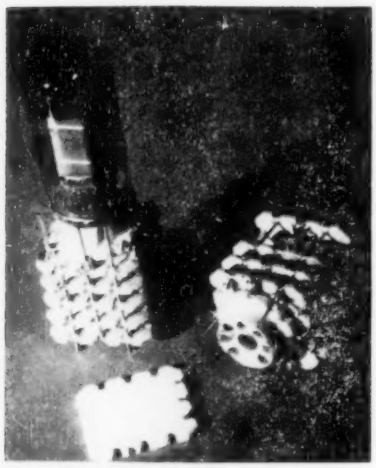
Progress through Problem Solutions

SP 10.3

that the National Bureau of Standards had developed an automatic factory for producing electronic equipment and it was in pilot plant operation. The code name for the operation was "Project Tinkertoy" (recently given the unwieldy designation of "Modular Design of Electronics" and "Mechanized Production of Electronics").

Within several weeks, more than 1,000 representatives from every electronics equipment and component manufacturer of consequence had journeyed to the "Tinkertoy" Mecca, just outside of Washington.

Industry learned that instead of trying to automatize conventional electronic components and construction techniques, NBS had developed new components and techniques specially suited to automation (AVIATION WEEK Sept. 28, 1953, p. 17, Oct. 12, 1953, p. 72).



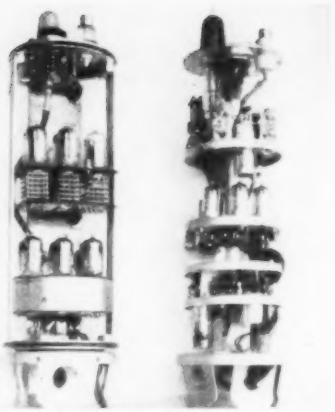
MODULAR-DESIGNED avionic sub-assembly (called MDE) turned out in "Project Tinkertoy" automatic factory is constructed from small ceramic wafers, uses tape resistors, printed capacitors and conductors.

▶ **Ceramic Modules**—Keystone of the process is a small ceramic wafer, seven-eighths of an inch square, which is machine-formed and upon which are printed necessary conductors. Printed capacitors on ceramic bodies, or resistors printed on tape, tube sockets, or inductors are attached to the ceramic wafers, several of which are then stacked and interconnected to form a completed module, all by machine operations.

Except for conveying wafers from one machine to the next, the present pilot plant is almost fully automatic, including testing machines which automatically throw out rejects.

▶ **Tinkertoy Advantages**—The Navy sees several attractive advantages to its new process:

• **Lower cost.** Recent study by a management consultant indicates that Tinkertoy plant can cut cost of building electronic equipment up to 44%, including amortization of the plant over a 10-year period.



COMPARISON of Navy sonobuoy constructed with conventional techniques, right, and new "Project Tinkertoy" MDEs, shows how new process eliminates familiar "rat's nest" of interconnecting wiring.

• **Versatility.** Tinkertoy plant can be changed over in a matter of several days to produce a variety of modules for different types of equipment. This is particularly attractive for converting a consumer goods plant to military production in an emergency.

• **Easy expansion.** Tinkertoy plant production can be quickly and easily expanded in an emergency by adding shifts, operating seven days a week, without need for training new personnel.

• **More uniform quality.** Elimination of manual operations and use of 100% inspection during manufacturing cycle should produce more uniform, better quality product, Navy expects. (One or two of the present pilot-plant machines are suffering more than 50% rejects, but are currently being redesigned.)

▶ **Some Drawbacks**—There are some limitations to the new process. For instance:

• **Expensive for small runs.** Initial tooling and set-up costs of a Tinkertoy mechanized line make it best for high production runs, yet many military items are produced in limited quantities of several hundred or a thousand, with frequent design changes during the run. The Signal Corps-GE machines, which can be converted simply by changing tapes or cards, may be better adapted, more economical for small runs. However, recent cost analysis indicates that Tinkertoy-type module construction, made with hand jigs, can be employed for small runs and offers almost as much economy as a mechanized factory line.

• **Limited capability.** Large-size capacitors, high-power resistors, inductors and certain other components cannot be made by Tinkertoy machines, at least so far. NBS is working to expand the range of values which can be obtained, but some observers feel that it will always be necessary to use some conventional components. Mixing manual and automatic operations negates some of the advantages gained by using Tinkertoy.

• **Restricts miniaturization.** Present Tinkertoy module size and weight compares favorably with conventional miniaturized construction, but is larger and heavier than conventional sub-miniature construction. Some observers have the opinion that the adoption of Tinkertoy may limit further size and weight reduction.

▶ **Industry Interest**—Westinghouse Electric Corp. is reported to be considering setting up a Tinkertoy plant, with the view to using its output both for military and consumer products.

There is reason to believe that American Car & Foundry, which recently set up an electronics division in Alexandria, Va. (near the pilot plant), has similar ideas. The new division is headed by J. G. Reid, Jr., and R. L. Henry, key men in the NBS Tinkertoy project.

The Navy reports inquiries from companies in Canada, Britain, France, Switzerland, The Netherlands, India, and Japan.

These developments, which could upset the traditional balance between component and equipment manufacturers, are being carefully watched. If an equipment maker sets up a Tinkertoy plant, he will spend fewer of his dollars with the components people. If the latter should set up a plant, as several are reportedly considering, it would reduce the equipment manufacturer's share of the pie.

Regardless of the future of the specific modular-type construction and mechanization which Navy-NBS have developed, Project Tinkertoy has sharply jolted industry with the realization that automation of electronics is no longer "around the corner."

▶ **Advancing the Art**—Electronics, a fast-moving science in its own right, gets a big shot in the arm when it joins hands with the military, and particularly with military aviation.

The continuing search for weapons superiority in a supersonic, hydrogen-bomb age has produced a condition in which military aviation is the biggest single force behind research in electrical technology and manufacturing know-how.

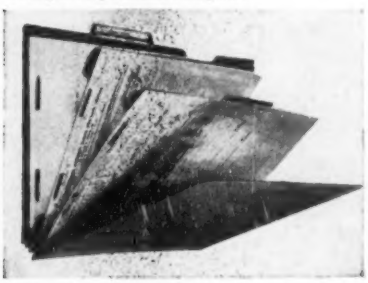
Industry and research laboratories engaged in avionics work are the vanguard of this march. It is in avionics that the frontiers of radar, computer, servo mechanisms, and communications knowledge are advancing most rapidly. From this knowledge will come the civilian and industrial products of the next and succeeding decades.

New Ways To Simplify Personnel Work

Mean More Efficient Administration . . . Tighter Control Over All Personnel . . . Reference Time Cut To Seconds!

One company now finds it takes only a few seconds to find wanted facts about *any one of its 5000 employees!* What's more all pertinent information is visibly signalled so that even such things as in-grade pay increases are handled automatically by clerks . . . thus relieving plant supervisors of the necessity of keeping and watching records . . . and assuring greater accuracy with much less clerical effort.

Previously, the personnel record for each employee of this company (Union Bag and Paper Corporation) consisted of an ordinary file folder into which papers were placed. In the event of a job change, rate change, credit or other reference, contents of the folder were leafed through until the proper sheet was found . . . and more often than not its contents completely disarranged!



Classifile Personnel Folders equipped with Kompakt fasteners, one on each side at opposite ends, lock all papers in position.

Let us show you how all this was changed so easily by the use of sturdy Classifile Personnel Folders fitted with space-saving patented Kompakt fasteners . . . which securely lock an employee's various groups of papers to the pages of this book-like folder . . . preventing accidental loss of a paper or disarrangement—even if the folder should be dropped.

Pertinent Information Visibly Signalled

Even more important, let us show you how easily and quickly all essentials of a paper are posted to the Kardex visibly signalled record, before it ever goes into the personnel folder. Hence, the Kardex at all times reflects at a glance, a complete picture of what is in the file. Condensed personal data from the application and a complete, active service-record is constantly at finger tips, for instantaneous reference and use.

Fire Protected Equipment

All personnel folders at Union Bag & Paper Corporation are housed in Remington Rand *certified* insulated Safe-Files . . . and all Kardex personnel records are housed in *certified* insulated Safe-Kardex. This equipment assures protection from the ravages of fire. Let us show you why more companies everywhere are finding such protection pays, and are turning to *certified* insulated equipment for personnel records.

Get the full story, "How Remington Rand Systems Simplified Personnel Records at the Union Bag & Paper Corp. of Savannah, Ga." Circle **CR906.**

New High-Speed Collator, a key punched-card machine for producing more timely reports . . . and reducing man-hours.

New High-Speed Machines Accelerate and Simplify Production and Cost Records

The High-Speed Collator with sequence check on both magazines, the Electronic Sorter with a speed of 800 cards per minute, and the 40-program, 150-card-per-minute Electronic Computer, make possible the preparation of payroll, production, cost and inventory records at speeds previously unattainable. For descriptions of the speed and flexibility these machines can bring to your accounting procedures, circle **TM156, TM842** and **TM887.**

Robot-Kardex Parts Control Boosts Record-Keeping Production 30%

Eleven Robot-Kardex units control the inventory of more than 23,000 separate parts at Cummins Engine Co.

Robot-Kardex saves up to 30% on posting time . . . up to 59% on space . . . physical fatigue, employee turnover.

Get valuable case history, "How Robot-Kardex Parts Control Saves Time and Money for the Cummins Engine Company, Inc. of Columbus, Indiana." Circle **CR909.**

Remington Rand

Room 1906, 315 Fourth Ave., New York 10

Kindly circle the literature you desire:

CR906		CR909
TM156	TM842	TM887

Name _____

Title _____

Firm _____

Address _____

City _____ Zone _____ State _____

— Profit-Building **IDEAS** For Business —

10 reasons for using SKYDROL

fire-resistant hydraulic fluid

Actual Extracts From Official Accident Reports Show How Hazardous Flammable Hydraulic Fluids Can Be

1. Landing gear suddenly retracted on take-off run. Plane skidded 2450 feet. Fire started in No. 3 nacelle, was extinguished once, broke out again. Second shot put fire out permanently. Fire was caused by the ignition of hydraulic fluid escaping through a hole worn in the strut by friction on the runway. Fluid was ignited by friction heat. Fire was subsequently fed by hydraulic fluid escaping from broken brake lines on the right strut.

2. Failure of rear bearing of cabin supercharger drive shaft dislocated shaft guard in Zone 2, which broke hydraulic pump case drain line. The freed hydraulic fluid was ignited by the hot failed parts.

3. Exhaust stack came off and exhaust burned through cowl flap, actuating hydraulic line and setting fire to hydraulic fluid.

4. Generator lead through stud in cabin bulkhead short-circuited in flight and set fire to hydraulic-fluid-soaked cabin insulation. Cabin filled with smoke, making landing maneuver difficult. Crash and crash fire resulted.

5. Failure of supercharger drive-shaft bearing allowed universal joint to rub through housing and cut hydraulic line directly above it. Fluid ignited on hot friction-heated metal. Nacelle burned loose and fell from airplane within 5 minutes.

6. Evidence indicates that the engine cowl flap hydraulic line failed when the flaps were opened for taxiing and that escaping fluid was ignited by engine torching or from contact with the hot exhaust manifold. Fire was extinguished by ground fire-fighting equipment.

7. Cargo airplane. Pilot completed landing, opened cowl flaps and while taxiing, noticed that right engine was on fire. Hydraulic line to the cowl flap cylinder failed.

8. Ground fire. Failure of flexible hydraulic line released hydraulic fluid when cowl flaps were operated.

9. Ground fire. Fire started in right nacelle during run-up. Apparently caused by cowl flap hydraulic line grommet failure which contributed to failure of line. Ignition believed caused by exhaust manifold.

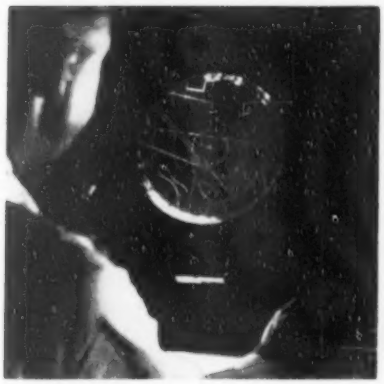
10. Ground fire. Excessive wear of brake friction-plate allowed the hydraulic pressure seal to release hydraulic fluid on the brake drums which were hot from several successive landings. Drums were hot enough to ignite the hydraulic fluid.

Skydrol: Reg. U. S. Pat. Off.

Do you have your copy of the new Skydrol brochure? If not, write us: Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478, St. Louis, Mo.

MONSANTO
CHEMICALS — PLASTICS

SERVING INDUSTRY... WHICH SERVES MANKIND



RADAR TRAFFIC CONTROL, using surveillance radar like this General Electric ASR-2, and war-surplus long-range military radar, has greatly improved traffic flow around major airports. If means can be found to enable Air Route Traffic Control Centers to use extremely long-range military early-warning radars, even greater strides can be made.

The Outlook for Civil Avionics

'New' ANDB May Be Key to Progress

Controversy still slows adoption of ultimate civil-military navigation system, but revitalized Board now has increased power and authority to act.

Avionic developments and events in civil aviation during the past year present a mixed scene of progress, controversy and discouragement. The recent reorganization and revitalization of the Air Navigation Development Board gives reason to hope that the controversy will be resolved and that a positive well-aimed program of development will result.

CIVIL DME equipment is in production by Narco and Bendix/Hazeltine despite the uncertainty regarding the program.

The past year saw:

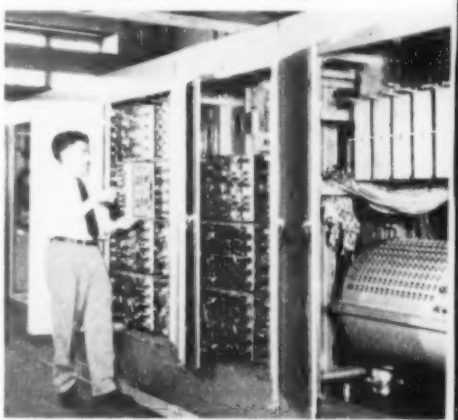
- **Controversy** over whether Civil Aeronautics Administration should convert its present civil DME (distance measuring equipment) to a newer military system, called Tacan.
- **Accelerated activity** in the development of an airline airborne weather radar, spurred by competitive and conflicting views on the best operating frequency for such a device.
- **Encouraging results** from the use of surveillance radar and peripheral VHF networks to speed air traffic flow.
- **Slow progress** in solving other traffic control problems.
- **Speedy action** in adopting a new selective calling system, called Selcal, designed to ease the pilot's radio monitoring duties.
- **Reorganization** of the Air Navigation Development Board, giving it increased authority and power, to resolve present DME controversy, prevent future problems of this nature, and spur the development of the ultimate common civil-military navigation system.

► **Uneven and Slow**—Compared to some of the radical military avionic developments, civil progress seems uneven, slow. In part, this is inherent in the nature of things.

The military gets the lion's share of development funds, with civil getting the table scraps. The military must and does reach out for bold technological advances, a risk which the CAA cannot afford. New civil navigation and communication equipments come into widespread use more slowly, and only when airline, business, and private fliers can justify them economically.

There is another reason. The ANDB program which should have provided many advanced common system developments was badly hurt several years ago.

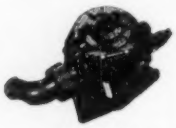
Disagreement within the ANDB resulted in the withdrawal of effective support by the military, who pulled out many important projects for exclusively military development. With very limited funds, and little authority, ANDB has had to limp along.



AUTOMATIC flight plan processor, designed to store up to 2,000 flight plans on a magnetic memory drum, search for possible conflict and provide information on approaching aircraft to Air Route Traffic Control Centers, is under evaluation by CAA.

you can
DEPEND
ON
ZEP
OXYGEN EQUIPMENT

All lines of oxygen equipment supplied by Zep Aero are the latest approved types of all-new products. The equipment is available for use by airframe manufacturers and executive aircraft owners.



REGULATORS
Demand & Positive Pressure Types A-12A & A-14

CYLINDERS
High & Low Pressure G-1, D-2, A-6, J-1 & Portables

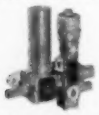
REGULATORS
Continuous Flow High & Low Pressure Types—AN 6010-1A & A-2000

BREATHING HOSE ASSEMBLIES
AN 6003 Series & Radio-wired Hose Assemblies

CHECK & LINE VALVES
High and Low Pressures

ANTI-G DISCONNECT AND HOSE ASSEMBLY

ANTI-G SUITS AND LIFE VESTS



ANTI-G VALVES
No. AN 6538-1 Type M-4 and M-8

PORTABLE AND FIXED EXECUTIVE AIRCRAFT INSTALLATIONS

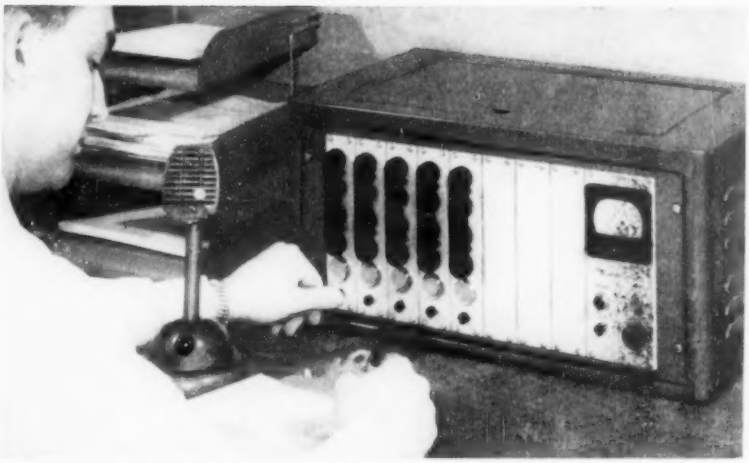
Government approved source for overhauling and servicing of military aircraft oxygen equipment.

Complete Oxygen Equipment Catalog Available on Request

CAA Approved Oxygen Repair Station 4073

ZEP AERO

109-116 Sheldon Street, El Segundo, Calif.
ORegon 8-1161



SELCAL, new selective calling system which enables airline ground stations to buzz individual aircraft when it wants to talk to them, has generated airline interest.

▶ **Whither DME?**—The present civil-military DME impasse is another direct result of the previous unresolved differences within ANDB, and in its wider implications, the cause of the original breakup. Since that time, the military has proceeded independently with development of its tactical navigation system (Tacan), along the "Ultimate Common System" lines recommended by Special Committee 31 of the Radio Technical Commission for Aeronautics.

Meanwhile, CAA has proceeded with implementation of the "Interim Common System," using VORs and DMEs recommended by RTCA's Special Committee 40. A recent CAA statement indicates that it intends to complete installation of all planned VORs and DMEs this year.

The military plans to use Tacan for aircraft operating in the U.S., and is concerned over possible interference between it and civil DME in some locations. Both are pulse-type systems operating in the 1,000-mc. band. The civil system uses 50 mc. of the band, with 2½-mc. channel spacing, and pulse-coding (multiplexing) to provide 100 individual interrogate and reply channels. Tacan requires 250 mc., with 1-mc. channel spacing, reserves pulse-coding for transmitting station bearing and other information.

▶ **The Military Problem**—The military, operating under an economy-minded administration, is confronted with two unpleasant alternatives in addition to the interference problem. These are:

• **Set up a Tacan network** which essentially duplicates existing federal airways and provide necessary operating and maintenance personnel at a cost estimated at $50 million.

• **Equip military aircraft** with both civil and military navigation gear, to enable them to operate in the U.S., yet fly overseas and operate in a tactical area on a moment's notice. This means added equipment costs, and—more important in jam-packed fighters and interceptors—added weight and space requirements.

This explains why the military now want CAA to modify its present civil DME ground stations to Tacan system. If this were done, military aircraft would obtain both distance and station bearing signals from CAA Tacan-DMEs, while civil aircraft would get only distance information. Civil aircraft would continue to use present VORs to obtain bearing information.

▶ **CAA Sits Tight**—So far, CAA has refused to budge, pointing out that it has already purchased 450 ground stations, all installed at their sites, one-third of them in operation. CAA, and civil DME supporters, say that a change would:

• **Delay civil DME use by** three to four years, requiring extensive modification of present ground stations, development of new civil airborne units. (Both Narco and Hazeltine/Bendix are now in production on civil airborne DMEs.)

• **Increase cost of airborne units** for civil aircraft, because of closer channel spacing and added design sophistication in Tacan, a serious objection for private and business aircraft operators.

• **Abandon proven system** for one which is still far from operational. (AVIATION WEEK inquiries to qualified people produce differing opinions as to whether Tacan is presently "de-bugged," an indication that some problems may still exist.)

▶ **Tacan's Civil Advantage**—Tacan supporters counter these arguments by pointing out that it has potential for growth into the ultimate common sys-

tem blueprinted several years ago by RTCA's Special Committee 31. By adding small adaptors to a civil Tacan-DME at some later date (when these portions are declassified), a single black box could provide distance, station bearing, transponder (safety) beacon, and possibly even private-line ground-to-air communications, they say.

The opposition acknowledges that some of the techniques used in Tacan may find application in the ultimate common system but says that the future system should not be handcuffed by Tacan's limitations. (For a more detailed presentation of the pros and cons, see AVIATION WEEK Dec. 7, 1953, p. 40.)

One of the first tasks of the reorganized ANDB is to evaluate Tacan for "possible later application in the common system," according to the official Commerce Dept. release. Observers expect the new ANDB to attempt to resolve the present military-civil DME impasse at the same time.

► **Brighter Radar Picture**—By contrast with DME, the airline weather radar program looks more encouraging. After more than a year of study, investigation and experimental flight test to establish requirements, development of airline radar for storm warning use is moving ahead full speed. The program is accelerated by technical disagreement over whether the older X-band (3.2 cm.) or newer C-band (5.7 cm.) is best for airline use.

Two manufacturers are currently in the race:

• **Radio Corp. of America** expects to fly a C-band prototype within 14 months, be in production within two years.

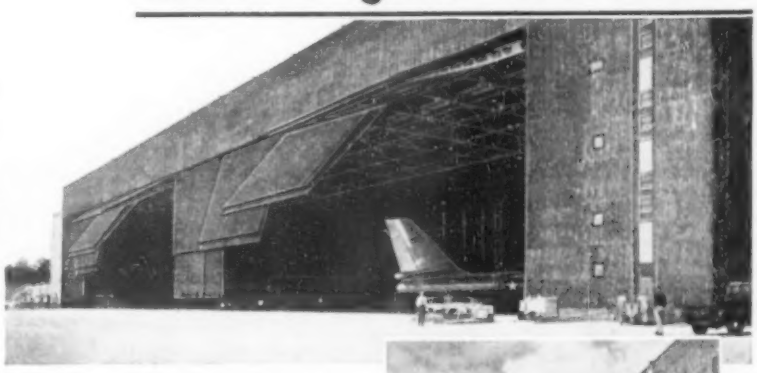
• **Bendix Radio** says it will fly a prototype X-band set in a few months, hopes to be in production within a year.

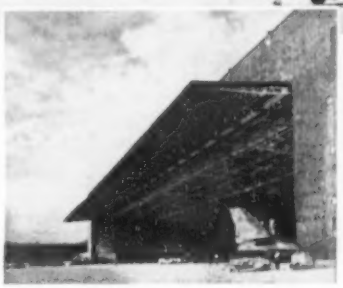
Arinc's Airlines Electronic Engineering Committee recently completed its airliner radar characteristic (spec) which calls for operation in C-band. AEEC's choice is based on the radar's primary intended use in storm avoidance and the accepted fact that C-band energy suffers less attenuation than X-band in heavy rainfall. A limited study by Drs. J. S. Marshall and Walter Hitschfeld, weather-radar experts at McGill University, indicates that C-band has considerably greater range of penetration through heavy rainfall.

United Air Lines has concluded that C-band radar is the optimum for airborne weather mapping purposes, on the strength of its analysis of last summer's tests on an experimental RCA C-band set. However, except for one informal and inconclusive test with a Navy R5D, there was no direct X-band versus C-band comparison.

► **Pros and Cons**—Opponents of X-band say that its shortcomings will show up

ALL DOOR and 352 yards WIDE





engineered and built for
LOCKHEED AIRCRAFT CORP.
Georgia Division, Marietta, Ga.
by INTERNATIONAL STEEL
in co-operation with
ROBERTS & CO. Associates,
Atlanta, Ga.: Architects & Engineers
BLOUNT BROS. CONSTRUCTION CO.,
Montgomery, Ala.: Contractor

You have to put up a BIG front for a flight hangar like the above — part of the immense Government Aircraft Plant No. 6, where Lockheed is producing Boeing-designed B-47's for the Air Force. And you have to all but fill it with doors, to provide an entrance huge enough for these giant Air Force Jets.

Lockheed's own needs were for 16 door sections — each 66 feet wide by 60 feet high — divided equally to form a dual-opening entrance. Each section operates singly — or any and all can be opened or closed concurrently. This adds up to two complete entrances each 528 feet wide — a total of 352 yards of combined door!

International was Lockheed's logical choice to handle this tremendous job. In operation, it duplicates other larger entrances designed and built by International. Much of the basic planning of these record-breaking projects was done with the help of International's door engineers.

This same experienced help can be put to work on your door problems . . . and on any problem involving steel fabrication . . . by calling in International. Mail coupon today for our complete catalog of Industrial and Aviation Doors.

INTERNATIONAL STEEL COMPANY
2014 Edgar Street, Evansville, Indiana
Send me, without cost or obligation, my personal copy of the new "International Doors for Industry and Aviation":
NAME
TITLE
ADDRESS ZONE STATE
CITY

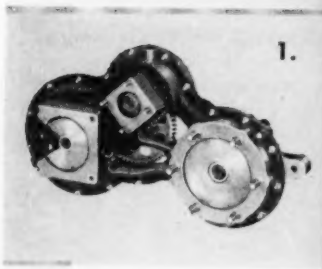
INTERNATIONAL SERVICE

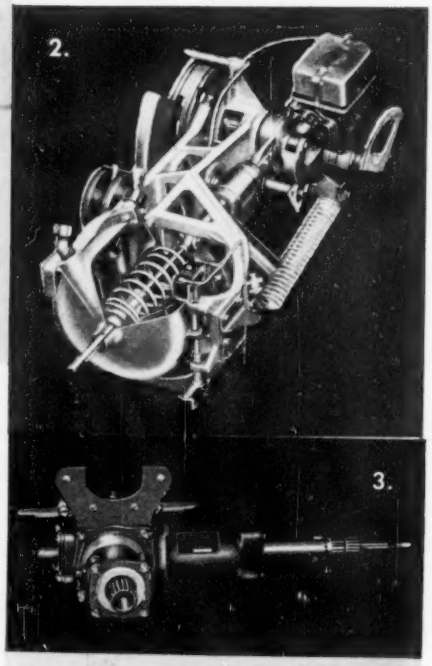
INTERNATIONAL STEEL COMPANY

Advance

Gear Assemblies do more jobs better

Precision is the watchword in aircraft engineering and it is the major factor of every ADVANCE Gear Assembly. No matter what the specifications may call for, ADVANCE is qualified to meet them with precision gear assemblies that give perfect performance under the toughest conditions. ADVANCE engineers and craftsmen combine many years of experience with the most modern equipment to produce gear assemblies that will meet your special requirements. Illustrated below are a few of the many difficult assignments that we have completed for the aircraft industry.





1. An integral part of the mechanism of a 40 HP turbine driven unit manufactured by Marquardt Aircraft Company.

2. This elevator trim and force producer assembly is part of Northrop Aircraft Company's Scorpion F-89-D.

3. Hiller Helicopters also use Advance facilities to produce such assemblies as this Tailrotor Gear Box.

Call or write us for further information.

Advance Gear & Machine Corp.

5851 Holmes Ave., Los Angeles 1, Calif., JE. 8103

when an aircraft must traverse a front containing heavy rainfall. X-band attenuation will give a false picture of storm depth, reduce the effectiveness of iso-echo contouring type radar display intended to show pilot paths of low turbulence, they say.

To this, X-band supporters point out that a C-band radar beam is almost twice as wide as X-band, for the same antenna size, will therefore be unable to see narrow non-turbulent paths between storm cores. They also point out that pilots will try to fly completely around storms, wherever possible. Through clear air or light rain, X-band is able to spot storms at a greater distance than is the case with C-bands. (For full discussion, see AVIATION WEEK Feb. 22, p. 52.)

► **Other Factors**—X-band radar is generally given a small edge from the standpoint of weight and size because C-band waveguides and magnetron are necessarily larger. X-band probably will have a price edge because RCA must develop a new C-band magnetron, although the company hopes to liquidate development costs over a long period and several other possible applications.

However, C-band supporters say the new magnetron will be conservatively designed to airline reliability needs, an advantage over an X-band tube developed for military use, where every ounce of performance is squeezed out.

► **Airline Interest**—Among the larger aircarriers, there appears to be considerable interest in weather radar. Panagra is installing a military AN/ASP-42 (X-band) set in a DC-6B, expects to be the first to try radar in regular operations, may be the first to equip its fleet, probably with Bendix radar. United is close behind, might soon order for its DC-7s. PanAm is planning to test the Bendix prototype (X-band) set this summer. Braniff currently has two APS-42s on loan from the Navy, is scheduled to install one this month. TWA and National are also interested.

An Arinc survey of airlines last spring indicated that practically all of the operators either wanted radar installed, or provisions for installation, in their future four-engine aircraft. However, only half of the future twin-engine aircraft were wanted with radar or installation provisions.

► **Speedy Action**—There is recent evidence that airlines and the avionic industry can move fast to make use of a new technological development for an operational need. The evidence is a new selective calling system called "Selcal." Selcal permits an airline ground radio station to flash a light or ring a buzzer in the cockpit of an individual plane to which it wants to talk, and

relieves the pilot of continuously monitoring his radio receiver for possible incoming calls (AVIATION WEEK Nov. 16, 1953, p. 71).

Pan American World Airways' Pacific-Alaska division recognized the problem, adapted an industrial calling system (developed by Motorola) for airborne use and tried it out. Selcal proved so successful, that PAA decided other airlines might be interested. Operating through Arinc's AEEC, an industry-wide system characteristic was prepared.

Two manufacturers, Motorola and Bendix Radio, quickly designed airborne and ground equipments for airline use. Motorola is already in pilot production, Bendix expects to follow shortly.

In addition to finding application in overwater carriers, Selcal may also be useful in domestic operations where pilots are spending more time monitoring Air Route Traffic Control Center VHF channels, making it more difficult for their company radio operators to raise them on their own HF channels.

▶ **Fewer Delays**—Air traffic now flows faster, with fewer delays in IFR (instrument) weather, makes more frequent landings and departures at and near high-density airports. This is the result of increasing use of surveillance radar and direct communications between Air Route Traffic Control centers and the aircraft operating under their supervision.

▶ **At Washington National**—Radar traffic control, pioneered at Chicago Municipal Airport and CAA's Technical Development Evaluation Center in Indianapolis, has been most fully implemented at Washington National Airport (AVIATION WEEK Mar. 16, 1953, p. 14). A war-surplus military radar gives the Washington ARTC center vision of all aircraft up to 100 miles away, extending the normal 30-mi. range of the control tower ASR-1.

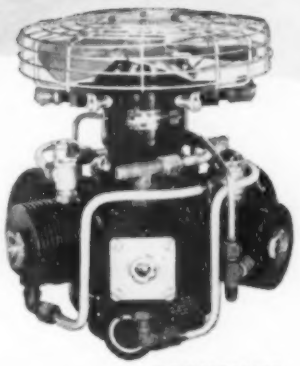
With radar sight, ARTC can funnel inbound, and reverse-funnel outbound, traffic with aircraft separation reduced from 15 to only five miles. Inbound traffic is fed to four main approach gates (fan marker, or compass locators) where control tower operators, using their ASR-1, take over.

▶ **Before & After**—During the first year of full radar control, Washington was able to:

- **Double airport capacity during IFR weather.**
- **Cut traffic delays.** Total delay time during three-month winter period was cut almost 9:1 over corresponding interval in previous year.
- **Virtually eliminate stacking.**

With increased operational know-how gained from experience, there has been further improvement this winter over last. A comparison of total ap-

Cornelius
PNEUMATIC
COMPRESSORS
FOR



CORNELIUS
COMPRESSOR
4 CFM
3000 PSI
HYDRAULIC
MOTOR DRIVE

CHANCE VOUGHT

NAVY CUTLASS

Chance Vought Aircraft uses Cornelius air compressors on the F7U-3 Cutlass, supersonic Navy interceptor. In specifying Cornelius compressors, Chance Vought recognized the need for a compressor that would perform well at high ambient temperatures and altitudes.

These Exclusive Design Features Show Why Cornelius Air Compressors Run Cooler Than Any Other Compressor

1. Heat of compression distributed over six cylinders.
2. Cooling fan is 8 inches in diameter with 1⅛ inch pitch.
3. Cooling fan turns at 5000 RPM.
4. The six cylinders have a total fin cooling area of approximately 950 square inches.
5. Intake valves are located in sides of cylinders—not in hot cylinder heads.
6. Finned cylinders are made of aluminum to provide for more rapid heat transfer.
7. Heat generating piston rings are not used.

If you have a requirement for a compressor to operate under high temperature and altitude conditions, please permit us to furnish additional information regarding our units. We will also gladly supply compressors on consignment, to qualified users, for test and evaluation.

CHANCE VOUGHT
F7U-3 CUTLASS
Supersonic Navy Fighter

THE Cornelius COMPANY
MINNEAPOLIS 21, MINNESOTA

PIONEERS IN THE DEVELOPMENT OF AIRCRAFT PNEUMATIC SYSTEMS

proach delays shows:

• **December 1952,** 4 hr. 15 min.: **1953,** 1 hr. 10 min.

• **January 1953,** 28 hr. 47 min.; **1954,** 2hr. 10 min.

► **Expanding Radar Use**—Surveillance radar is now used for IFR arrival and/or departure control by towers at all three New York airports, at Chicago, and at Los Angeles. It will eventually be used at 52 major airports slated to get ASRs.

There are still problems, however. Exercising arrival and departure control in high-density traffic normally requires two radar operators, but at present both must crowd around a single PPI scope. Lack of bright-tube radar displays still forces radar operators to sit under "tents" during daylight hours, another inconvenience. Limited CAA funds are generally blamed for slowness in developing and providing these improved facilities.

ARTC centers are still operating without long-range surveillance radar, except at Washington. There is much talk of using military early warning (MEW) radars now located near ARTC centers. Principal problem is to get necessary money to set up microwave relays or other means of piping air defense radar presentations into ARTC centers. Funds may become available this year to provide such facilities to a few major ARTC centers.

► **Direct Communication**—To take full advantage of its radar vision, ARTC needs, and is getting, facilities to permit direct communication with en route aircraft. Previously, ARTC controllers had to relay instructions through individual airline radio operators. Sometimes it would take five minutes from the time an ARTC controller issued instructions for an airplane to descend to a new altitude before he received assurance that the airspace was available for assignment to another aircraft. This resulted in poor airspace utilization.

By giving ARTC centers a single VHF channel, and later expanding the number of channels, part of the bottleneck was broken. However, VHF's line-of-sight range limitation (75-100 miles) has led to a new scheme, called peripheral communications, i.e., remotely located VHF stations tied in by telephone line to an ARTC center.

The idea was first tried at the New York center, with stations located at West Chester and Scranton, Pa. (AVIATION WEEK Jan. 26, p. 38). These two stations effectively doubled the range at which controllers could contact aircraft.

► **Remote VHF Payoff**—The New York center's traffic capacity has been increased 18-25%, largely as a result of its peripheral communications, a CAA spokesman estimates. For instance, three aircraft can now be laddered down in altitude in four minutes instead of nine. Its success has resulted in plans for similar facilities at other major centers, including Washington, Chicago, Boston, Pittsburgh, Indianapolis, and Cleveland (which already has one remote station at Buffalo.) Date of implementation will depend upon how far CAA can spread its funds.

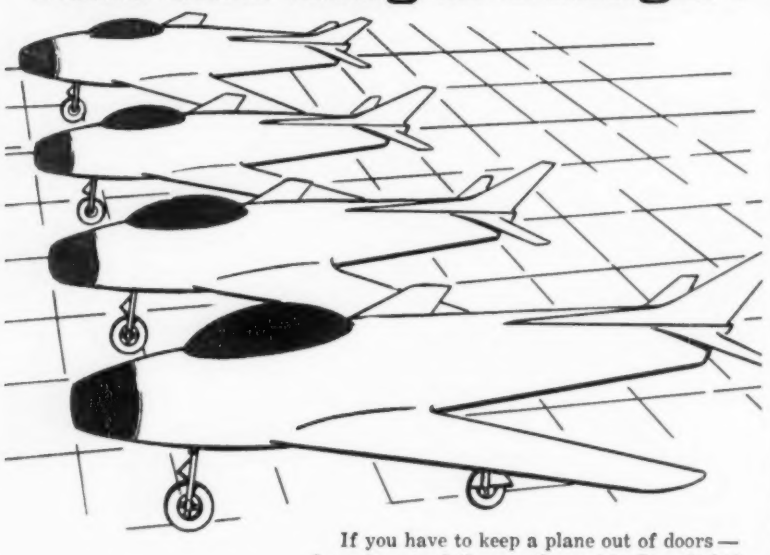
Installation of UHF equipment, for use with military aircraft, has been slow at ARTC centers. (It is also slated for use at remote sites.) Reason is reportedly a shortage of ground-station equipment because of disagreement over whether CAA or the military should finance installation.

► **Less Encouraging Progress**—"If it were not that the present flight-progress strip system (for keeping track of aircraft under ARTC control) were actually in existence, it would be difficult to convince any reasonable person that such a system could be made to work at all," S. P. Saint recently told the annual meeting of the Institute of the Aeronautical Sciences in New York. Saint is director of ATA's Air Navigation and Traffic Control Division.

Despite many studies of the problem, ARTC controllers are still using essentially the same manual posting technique they have always used, with

Vulcan *Coverlight*

next best thing to a hangar!



If you have to keep a plane out of doors — keep it out of the weather with *Coverlight!* *Coverlight*, a skillful blending of nylon and neoprene, is 100% waterproof . . . resists sunlight, mildew, fungus, abrasion . . . actually is the toughest, lightest, longest-wearing protective covering you can use. *Coverlight* can be made to meet Federal Specs: MIL-F-7719 (AER) and MIL-C-4479 (USAF). Send for free sample and folder.

Vulcan Industrial Coated Fabrics

Vulcan offers a wide selection of synthetic coated fabrics for fuel pump diaphragms, gaskets, regulators, etc. Vulcan, now a subsidiary of Reeves Brothers Inc., also offers the aviation field complete engineering, and research facilities.

west coast: P. W. Sampsell, West American Sales Co., 470 N. Avenue 19, Los Angeles 31, Calif., Phone: GA 8-1148

southwest: Garvice K. Hill, 6503 Blue Valley Lane, Dallas, Texas, Phone: Tenison 2363

VULCAN RUBBER PRODUCTS INC., *54 Worth St., New York 13, N. Y.*

Manufacturer of Vulcan-Duroflex products • Subsidiary of Reeves Brothers Inc.

vastly increased traffic density. During the past year, ARTC controllers filled out an estimated 15 million flight progress strips in longhand, noting pertinent identifying information on the individual flight and its estimated time of arrival over the next position fix. As aircraft give revised ETAs, or are given new altitude assignments, the controller must cross out the old figures and write in the new ones.

The progress strip is normally placed before the controller 40-60 minutes before the flight is due over the fix, is retained until 10 minutes after the flight passes. For 300-mph. airliners, four to seven of these strips must be prepared for 30 minutes of flight; a jet will use them up even faster. Strips are racked up in front of the controller in order of their ETAs, without any attempt to give a graphic display of aircraft altitude or relative position.

▶ **Progress Strip Limits Progress**—As a result, Saint points out, "The controller must discover a conflict or . . . (an opening for) additional clearance . . . by conscientious and continuous examination of this large volume of handwritten data (which is) not capable of automatic transmission or display. There is no way to interlock or coordinate automatically at the many boundries of control jurisdiction," Saint points out. "This . . . will drastically curtail the efficient use of radar (in ARTC centers) . . . (and) efficiency drops sharply when an unexpected irregularity occurs."

▶ **Pity the Controller**—Stanley Seltzer, former chief controller at Washington National Airport, now a member of ATA's ANATC division had this to say in speaking before the IAS:

"To force the manual system to absorb the increased traffic load (there has been) division among greater numbers of controllers (with each) given a smaller and smaller area to control.

"However, this has only added to the problem by increasing the amount of coordination necessary between controllers . . . (which) involves a majority of (their) time," Seltzer says.

▶ **Many Studies, No Cure**—At the IAS meeting, Saint pointed to an 18-inch-high stack of previous study reports on various types of visual traffic display systems to replace the much-criticized flight progress strips, then proposed his own ideas for a new system, the result of an ATA study.

The system resembles the "block system" of control used by the railroads. Aircraft positions in the controlled blocks are indicated by small "tokens," which controllers plug into their individual consoles. An electrical interlock system, operated by the tokens, flashes lights to show when aircraft may be cleared to next block or assigned to new altitude. Position of tokens gives graphic portrayal of airplanes' relative positions.

By the time Saint had developed his system from its simple fundamentals to accommodate traffic intersections, it was apparent that the complexity of three-dimensional aircraft traffic flow precludes any simple solution and may explain why ARTC is still using the old flight progress strips. Saint expects to submit the idea to the Air Coordinating Committee for further study and analysis, to focus attention on the problem.

▶ **Not Oblivious**—ANDB and CAA have not been oblivious to the need for automatic data handling equipment to post and transfer aircraft flight plans. They are currently starting to evaluate a magnetic-memory digital system at TDEC in Indianapolis. Developed by Engineering Research Associates division of Remington-Rand, the machine is essentially a large digital computer designed to perform two important functions:

• **Flight plan processing.** Some 2,000 flight plans can be electromagnetically filed, stored, and quickly scanned (0.4 sec.) for possible conflict. As envisioned, the device could automatically transmit flight plans to ARTC controllers along aircraft's route as needed.

• **Weather data processing.** Device can also store up-to-date weather observa-

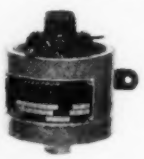
A Revolutionary New LIGHTWEIGHT Aircraft Engine that Develops
40 H.P.
YET WEIGHS ONLY 50 POUNDS
The NELSON H-59
For Powered Soaring Planes and Many Other Uses...
• The new Nelson H-59 Aircraft Engine was designed to provide auxiliary power for the famous Nelson "Dragonfly". It develops ample horsepower for takeoff, landing, and cruising of this fully loaded, two-place sailplane. This simple, dependable, and practical four-cylinder engine can be operated as efficiently and economically as the motor in your automobile. A thoroughly tested, dependable engine with a power-to-weight ratio that makes it applicable for many other uses...with crankshaft either in vertical or horizontal position.
Tested and Approved by C.A.A. for Powered Soaring Plane Use
SPECIFICATIONS
• 4-Cylinder, 2-Cycle, 2-Port Design
• Air-Cooled
• Battery Ignition
• Cable Starting
• Develops 40 H.P. at 4,000 R.P.M.
• Fuel Consumption 4-1/2 Gals. Per Hr. at Full Throttle.
Write Today for Complete Details
W. F. & JOHN BARNES COMPANY
301 S. Water Street • Rockford, Illinois

The electronic computer gulps algebraic equations and releases typed solutions, at the rate of 10,000 per minute. Men with vision created this machine that almost *thinks*, men who were dissatisfied with old fashioned methods.

Dissatisfaction—

AMERICA'S GREATEST ASSET

Computing machines have created one of the fabulous chapters in the history of American industry. A few enterprising men in each generation have been unwilling to tolerate mediocre tools and methods. They are the physicists, engineers and designers who today are meeting the requirements of our changing world. At Meletron we are testing new materials and creating new techniques to meet constantly higher standards. Dissatisfaction with what has been done, plus the determination to improve, is one of America's greatest assets. This attitude is a guiding policy at Meletron.



MELETRON® CORPORATION

930 NORTH HIGHLAND AVENUE, LOS ANGELES 38, CALIFORNIA

J. M. WALTHEW CO., Boeing Field, Seattle. THOMSON ENGINEERING SERVICE, 708 Hemphill St., Fort Worth and 732 So. Broadway, Wichita. ROUSSEAU CONTROLS Ltd., 2215 Beaconsfield Ave., Montreal 28, Canada. W. M. HICKS & J. A. KEENETH, 29-27 Forty-first Avenue, Long Island City, New York. JOSEPH C. SORAGHAN & ASSOCIATES, 1612 Eye St., Northwest, Washington 6, D.C.

tions and forecasts from many remote stations, for immediate access by any station in the network.

Present thinking is that teletypes will be used to feed flight plan or weather data to the machine; special display boards or teleprinters will be used to obtain information from it. The application of the machine involves both operational and technical problems which TDEC must work out.

► **Indianapolis Center**—New traffic control aids and procedures will get their evaluation in an actual operational environment after this summer, when the Cincinnati ARTC center moves to the Indianapolis Weir-Cook Airport to become part of the new Airways Operations Evaluation Center (AOEC) being established.

AOEC will explore the wider use of radar traffic control, using PAR, ASR, long-range S-band and L-band radars, and eventually airport surface detection equipment (ASDE), a very-high-frequency radar for airport surveillance.

AOEC plans to explore several techniques for operating remote enroute radars, piping their pictures into an ARTC center. Techniques will include microwave relay, broadband cable circuit, slowed-down video to permit use of narrow band telephone lines.

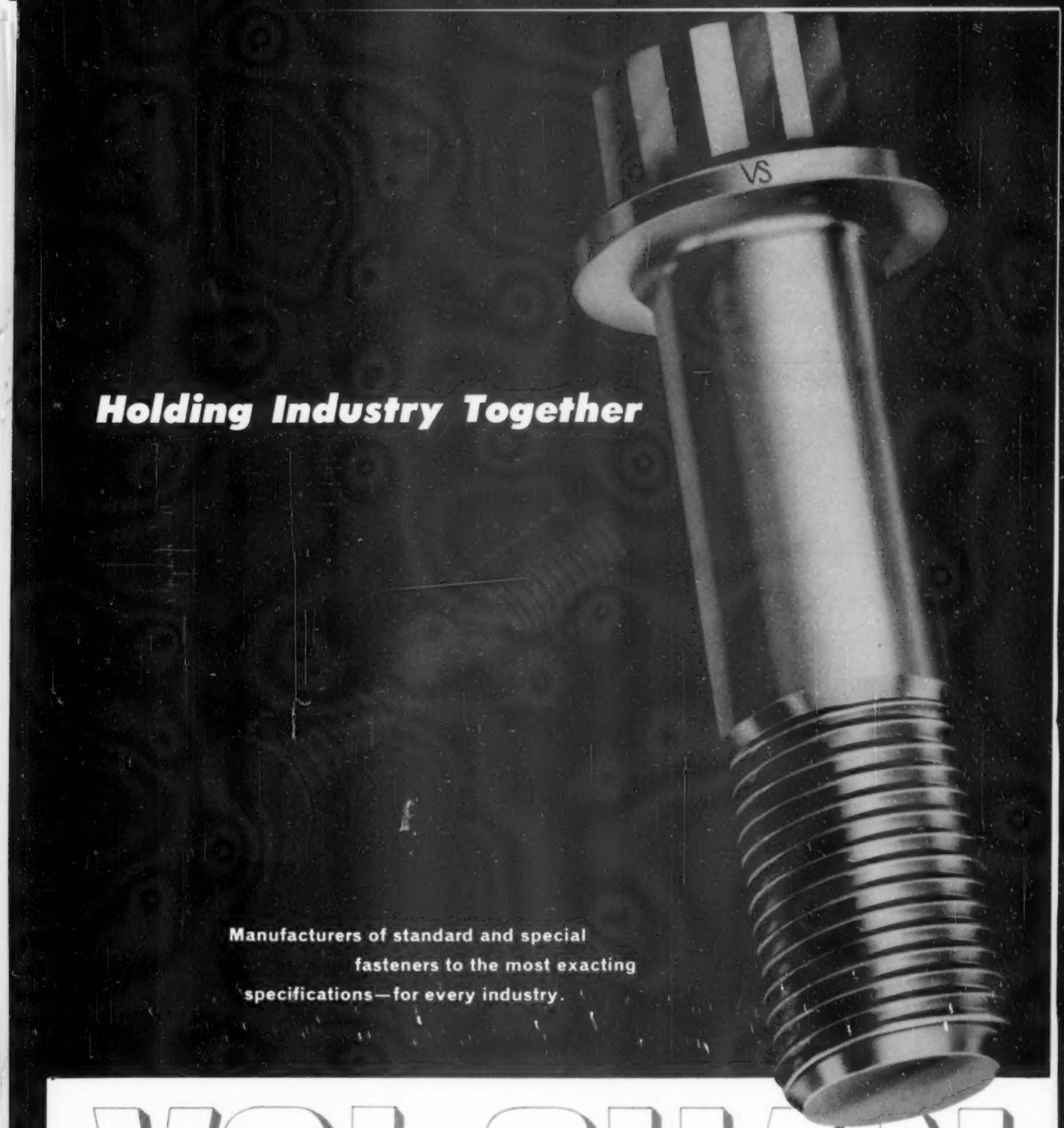
AOEC also intends to evaluate several techniques for identifying individual aircraft on radar scopes, including use of radar (safety) beacons, ground direction finders, position fixes that are established by means of airborne VOR-DME.

► **Human Engineered Centers**—Another important objective of the AOEC program is a more efficient ARTC center design, including better communication and handling procedures, with adequate attention to principles of human engineering. Bell Telephone Laboratories are under contract to develop improved interphone systems, air-to-ground communication consoles, floor plan layouts and acoustics.

To evaluate suggested improvements and new techniques, AOEC will have dual ARTC facilities within a single room. On one side will be the regular operational center, always ready to perform required duties. The other side will be an experimental center in which new ideas are incorporated. When these are ready for evaluation, one or more of the ARTC controllers will shift their chairs to the other side of the room.

If new devices prove unsatisfactory, the controller can instantly return to the regular center. If they prove desirable, the improvements will be incorporated in the regular center.

► **Progress Slow**—Despite ambitious plans, progress is spotty. For instance,



Holding Industry Together

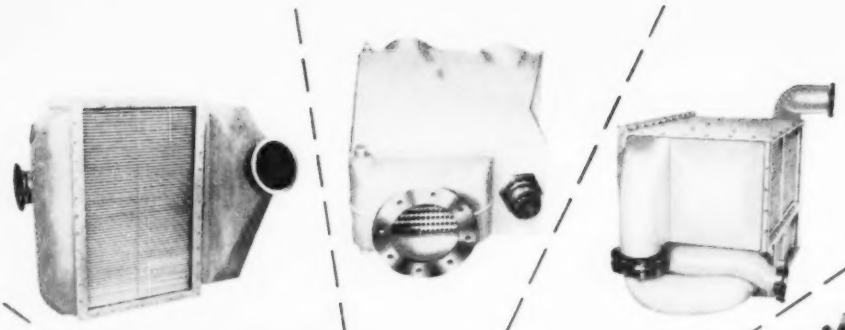
Manufacturers of standard and special fasteners to the most exacting specifications—for every industry.

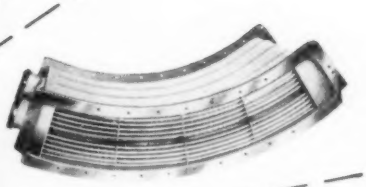
VOI-SHAN

MANUFACTURING COMPANY, INC.

Serving the Aircraft, Automotive, Marine, Rail, and Oil Tool Industries

8463 HIGUERA STREET • CULVER CITY, CALIFORNIA



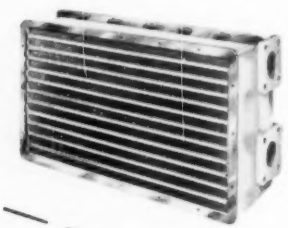


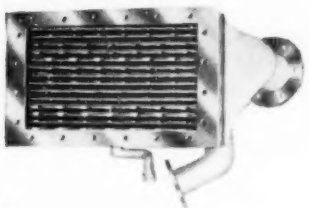
LIGHTWEIGHT, THINWALL

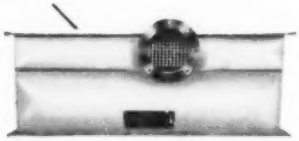
heat exchangers

AIR TO AIR

AIR TO LIQUID · LIQUID TO LIQUID







Stainless Steel or Aluminum to meet your specific design needs!

To meet the challenge of higher temperatures in advanced jet engines, South Wind has developed new lightweight, thinwall stainless steel heat exchangers. These heat exchangers fully comply with the rigid specifications set up by airframe and engine manufacturers, as well as the makers of air cycle cooling packages.

In addition to stainless steel, thinwall aluminum heat exchangers also are being designed and fabricated at South Wind for many different applications. Heat transfer from air-to-air, liquid-to-liquid, and air-to-liquid is being achieved effectively with the new South Wind heat exchangers, which utilize either the tube bundle or the plate and fin types of design . . . whichever the job requires.

For Aircraft Heating or Cooling—Pioneers in the field of aircraft heat exchange equipment for providing heat, South Wind has now put that experience to work in the development of heat exchangers for cooling purposes . . . another service to the aircraft industry.

Whatever your need in heat transfer equipment, South Wind's experienced engineering staff will be glad to consult with you. For information, write Stewart-Warner Corporation, South Wind Division, 1514 Drover Street, Indianapolis 7, Indiana.

South Wind

A PRODUCT OF SW STEWART WARNER

AIRCRAFT HEATERS
HEAT EXCHANGE EQUIPMENT
INERT GAS GENERATORS

airport surface radar (ASDE) was an early postwar development, and a modified version was tested for several months in 1952-53 at N. Y. International Airport. Yet an improved equipment (less affected by rainfall) now under design will not be available to AOEC until 1956-58, an ANDB spokesman estimates.

The important airborne radar beacon development program, intended to provide positive means of identifying aircraft on ground radar scopes, has suffered many delays and false starts. Last summer the program was re-launched on the basis of L-band (1,000 mc.) operation with interrogation by special (secondary) ground radars. But the program is once again up in the air because the military has indicated that a new choice of frequency may be necessary.

There are many explanations for the slow pace, but an important one is the lack of a strong ANDB program with full civil and military support and adequate funds. For several years, military avionic development funds have run almost 100 times those of the CAA-ANDB. In the post-Korean period, when demand far outstripped avionic industry facilities and manpower, the military has had top priority, if only by virtue of its funds.

► **Eyes on ANDB**—The aviation industry has its eyes focused on the newly reorganized ANDB to see whether its new top-level members can resolve problems which splintered the previous group. Their first task is to resolve the civil DME versus Tacan hassle, about as tough a problem as they could have found.

ANDB's success in solving this and other difficult problems, and in laying out a long-range "Ultimate System" development program during the coming months will determine whether we have a navigation system which meets the needs of the next decade, and whether it is a "common" civil-military system in name only or in reality.

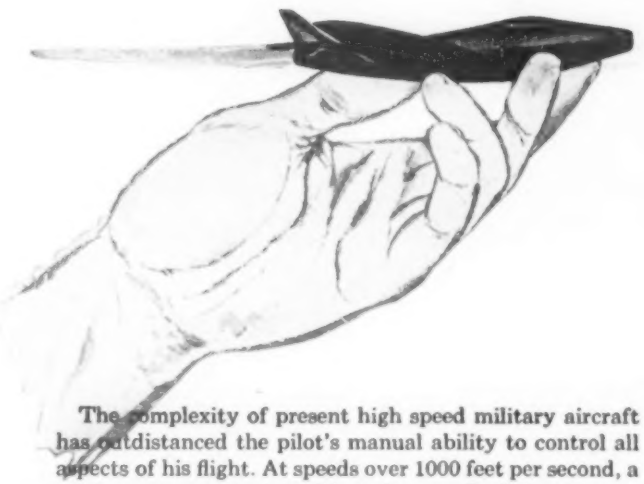
► **Military Dividend**—Many of the military avionic developments now under security wraps will in time be declassified for civil use. At least much of the technical know-how will find civil application. Tacan and digital communications are two examples.

Civil aviation will benefit from microtronic construction techniques which will permit major size and weight reductions for growing numbers of avionic equipments which have been encroaching on airliner payload. In lightplanes this sub-sub-miniature construction will permit better all-weather instrumentation without seriously compromising payload.

These are some of the worthwhile by-product returns which civil aviation can expect from tax dollars which go into military avionics development.

the pilot's unseen helping hand—

AEROTEC AUTOMATIC CONTROLS



The complexity of present high speed military aircraft has outdistanced the pilot's manual ability to control all aspects of his flight. At speeds over 1000 feet per second, a pilot must concentrate on his trajectory. Such functions as fuel transfer, tank-pressure regulation, afterburner eyelid control, cabin pressurization and fuel-filter de-icing must be accomplished automatically. In these functions, AEROTEC Float Switches, Valves and Pressure Switches have contributed greatly to the solution of flight problems at trans-sonic speeds—truly a pilot's unseen helping hand!

AEROTEC Automatic Controls have passed extensive qualification tests *simulating actual flight conditions* in accordance with Spec MIL-E-5272. They are installed on such high speed aircraft as the Boeing B47B and B52, Grumman F9F-6, Northrop F89D and Lockheed F94C.

Constant research by AEROTEC Engineers into problems of hermetic sealing, high-pressure actuation, corrosion and high- and low-temperature conditions has maintained AEROTEC'S reputation as progressive designers and manufacturers of the highest quality products.

Let our qualified engineering staff help solve your automatic control problems. One of our specialists is near, ready to serve you. Call or write today

When you think of Automatic Aircraft Controls, you should automatically think of AEROTEC.

Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONNECTICUT

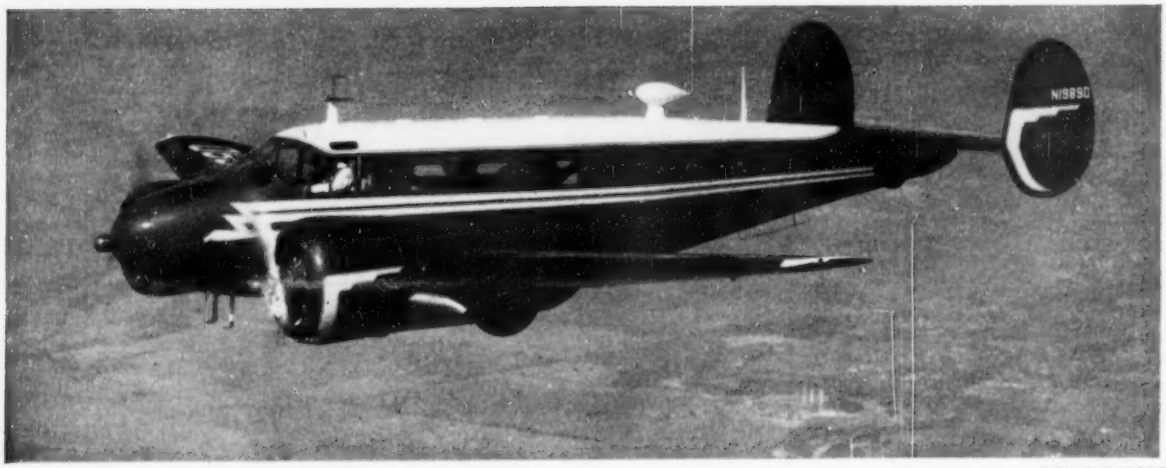
(Offices in all principal aircraft centers)

Canadian Affiliates: T. C. CHOWN, LTD. Montreal 25, Quebec • Toronto 5, Ontario

THE AEROTEC CORPORATION

AIRCRAFT DIVISION — **GREENWICH, CONNECTICUT**

Designers and Manufacturers of Automatic Controls—*Valves:* Regulating, Relief and Check types—*Pressure Switches:* Gage, Altitude, Differential and Absolute Types—*Float Switches:* Top, bottom or side mounted—Single, Dual or Tandem.



BEECH D18S

Business Flying

Multi-Million Market Goes Begging for Takers

Business flying, still riding the crest of its phenomenal postwar boom, is expected to gain even wider acceptance during 1954 as more companies take to the air in their own planes.

Lifting of the excess-profits tax in January was interpreted in some pessimistic quarters as the turning point which would see companies taking inventory of the high cost of operating aircraft with a view to eliminating this "luxury" item from their budgets.

▶ **Here to Stay**—But the trend seems to be exactly the reverse, as more U. S. business firms accept the premise that convenience and time saved in flying high-priced executives more than compensate the cost of aircraft operation.

Stockholders, heretofore the most inclined to rebel over airplane expenditures, seem to be taking a more liberal view and are becoming increasingly air-minded in their thinking.

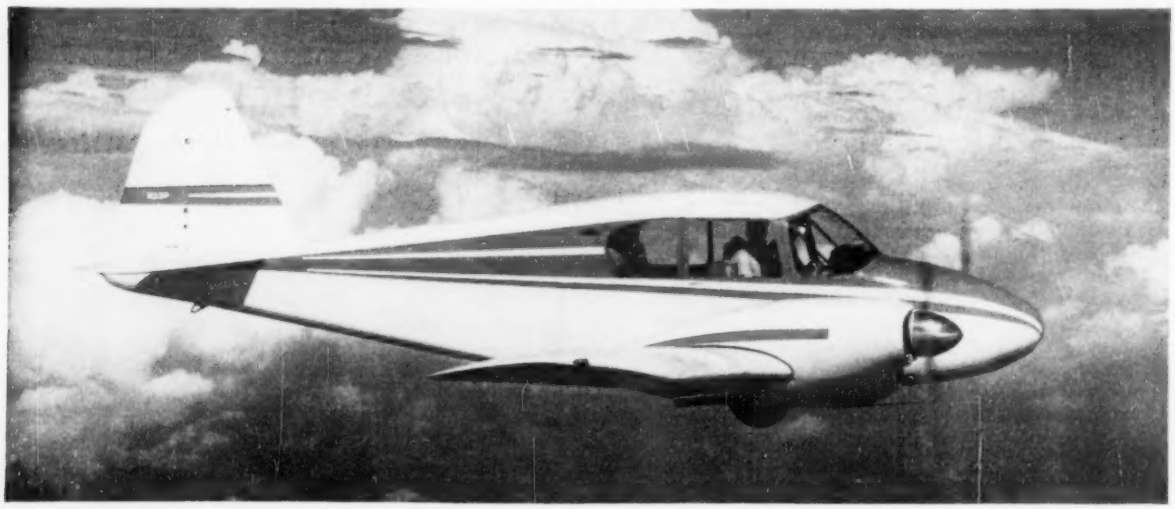
From all of the present indications, it would appear that business flying is here to stay.

▶ **Growing Pains**—Certain basic problems must be solved, however. Business flying is currently going through a series of "growing pains" that must be treated skillfully if the field is ever to realize its full potential as an integral part of U. S. industry.

Right now, it's going through what might be called the "awkward" stage, having reached the maturity of a full-grown segment of aviation but still waiting for organizational and technical advances to catch up with it.

▶ **Major Problems**—Some of the chief problems:

• **Lack of adequate equipment.** Present owners for the most part are not satisfied with their aircraft. Either they are using obsolete transport models, converted World-War-II bombers, or, as a compromise, they are operating later models that are not particularly suited for their purposes.



PIPER APACHE

CESSNA 310

These planes may be outstanding designs in their own right, but the majority of flying executives holds either capacity or performance-wise they do not meet all of the requirements for a business aircraft.

• **Lack of basic information.** Companies operating business planes, and those contemplating such operation, are in desperate need of a common medium whereby they can obtain basic information on the field and also exchange ideas on operating procedures to mutual advantage.

• **Lack of market data.** Manufacturers, desirous of producing equipment for the business flying market, find that there is an acute lack of information upon which to base specifications for such equipment.

A plane designed specifically for company use, for example, is the dream of most business flying enthusiasts. Operators want such a plane badly, and manufacturers would very much like to produce it.

But in the absence of a common medium through which companies can get together, define what they want in the way of specifications and present unified proposals to the manufacturers, a complete stalemate exists.

Before manufacturers will go into production of a plane specifically designed for business use, they must know exactly what the operators want and they must have an estimate of the size of both the actual and potential markets. Also, they want something in the way of a cash guarantee to help finance production costs.

▶ **Charting a Course**—Some feel that in the absence of a unified proposal by the operators, the only recourse may be initiation of an intensive market research program by the manufacturers themselves.

Two things seem certain:

• Until definite specifications are arrived at, the multi-engine business fleet will continue to be made up of obsolescent and "compromise" aircraft.

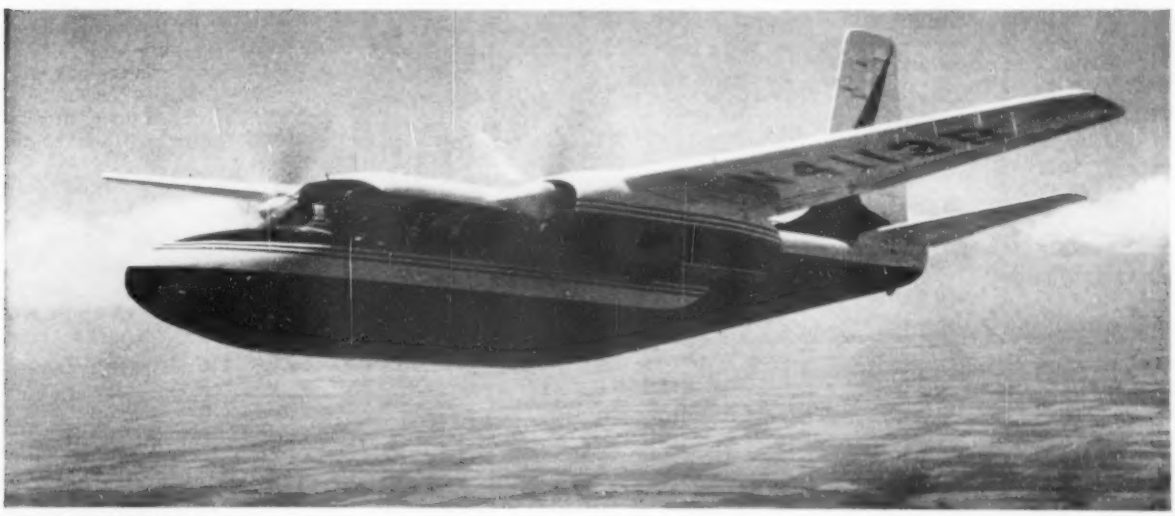
• In order to ascertain both specifications and size of the market, mutual cooperation is needed between operators and manufacturers.

Until such a close-working, operator-manufacturer relationship is brought into being, it is considered doubtful that any type or types of multi-engine aircraft specifically designed for business flying requirements will ever get beyond the drawing boards.

It would be a shame, observers feel, if this new and vitally important segment of aviation were allowed to deteriorate before it has a chance to reach its full potential.

But indications are that this could happen if something isn't done soon toward design and production of specific equipment.

▶ **Can They Compete?**—Companies will probably settle for whatever is available for the next two or three years, but by that time the business fleet, made up of compromise planes, will be in no position to compete with the ever-increas-



AERO COMMANDER

ADAMS-RITE HANDLE

AR 33
General utility handle, escutcheons available.

AR 71
Balanced grip for direct pull, escutcheons available.

AR 30
Minimum projection handle, escutcheons available.

AR 83*
Heavy duty locking handle.

AR 87*
Streamlined heavy duty locking handle.

AR 88*
Heavy duty locking handle.

*Free wheeling if desired

ADAMS-RITE MANUFACTURING CO.

Eastern Representative—Reciputi & Weiss, Inc., Amityville, N.Y.
Midwest Representative—George E. Harris & Co., 1734 N. Hillside, Wichita, Kansas, Offices: St. Louis, Kansas City, Dallas.
Canadian Representative—Railway and Power Engineering Co., Montreal. Offices throughout Canada.

TEMCO TWIN-NAVION

ing speed and efficiency offered by commercial airlines if it cannot offer comparable or even better service.

It would be unrealistic to assume that one plane specifically designed for business flying would satisfy the requirements of all U. S. firms operating aircraft, observers feel. But it would be a step in the right direction. If the specifications are sound, it should satisfy the mass market.

Some smaller companies, of course, cannot afford and do not need the type airplane that most of the larger corporations require. For example, a plane capable of 1,000-mi. range, 300-mph. cruising speed and capacity for 10-12 passengers would perhaps be suitable for larger organizations, but smaller companies can do with the lesser performance and capacity of models presently on the market.

► **Tempting Market**—The fact remains, however, that there is an estimated multi-million dollar market among larger corporations for an efficient, high-performance multi-engine business plane—a plane currently not in existence. This is the market that must be satisfied if business flying is to continue on a large scale.

The desire of corporations for such an aircraft should not be construed as criticism of all of the planes that make up the present business fleet. Each is considered capable in the job it was designed to do, but none has the overall characteristics required for a business plane.

Collectively, they come close to meeting all of the requirements, but individually most fall far short of the mark. Some operators are satisfied, for the present, but the more progressive companies are considering the outlook for the future—three to five years from now.

What they want is a 1956 or 1958 design that will be capable of equaling or bettering the airline service of that day.

So far, nothing is in sight.

► **Impressive Record**—In the meantime, companies operating business planes continue to compile an impressive record with the equipment at hand.

Newest twin-engine models in today's business fleet include:

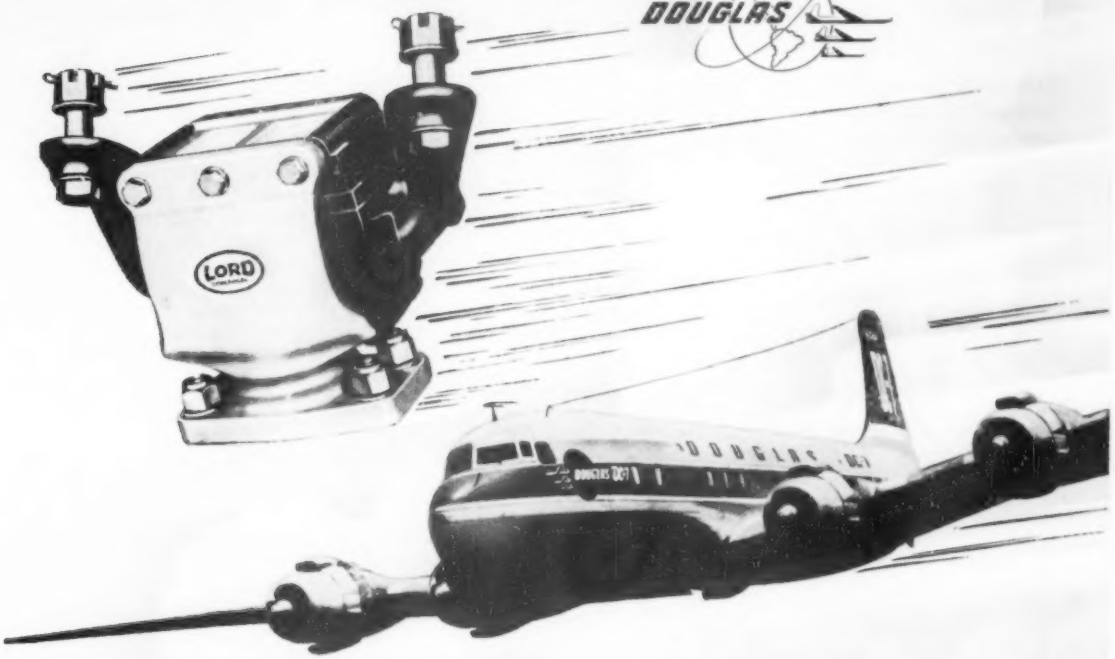
- **Beechcraft Super 18,** modified, "souped-up" version of the Model 18.
- **Aero Commander,** manufactured by Aero Design & Engineering Co.
- **Beech Twin-Bonanza,** Model B50.
- **Apache,** Model PA-23, manufactured by Piper Aircraft Corp.
- **Cessna 310,** manufactured by Cessna Aircraft Corp.
- **Learstar,** a stripped-down, souped-up modified version of the Lockheed Lodestar-18, converted by Lear, Inc. This 10-passenger plane is reported to have improved overall Lodestar performance, cruising at 270 mph. at 10,000 ft. Some feel that this might be the interim answer for a business plane.
- **Temco Twin-Navion,** twin-engine conversion of the single-engine Navion.

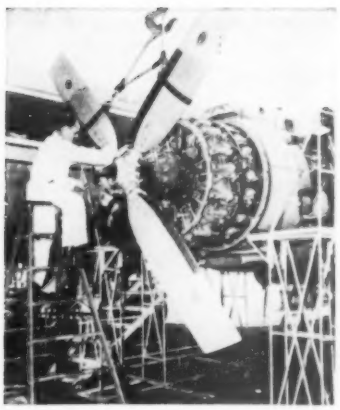
Powerplants, size of accommodations and amount of instrumentation vary

BEECH 50 TWIN-BONANZA

LORD Dynafocal Engine Mountings

ON THE NEW DOUGLAS DC 7





Safety . . . Speed . . . Comfort characterize the new Douglas DC 7, "the world's fastest piston-powered commercial airliner". Contributing to these factors, Lord MR43 Dynafocal Engine Mountings and Bonded-Rubber parts control vibration throughout the aircraft.

Lord Bonded-Rubber parts will help to protect your product from the damaging effects of vibration and shock . . . improve its performance. We invite you to make good use of our experience.

LOS ANGELES 28, CALIFORNIA
7046 Hollywood Blvd

CHICAGO 11, ILLINOIS
520 N. Michigan Ave.

CLEVELAND 15, OHIO
811 Hanna Building

DALLAS, TEXAS
313 Fidelity Union Life Building

DAYTON 2, OHIO
410 West First Street

DETROIT 2, MICHIGAN
311 Curtis Building

NEW YORK 16, NEW YORK
280 Madison Avenue

PHILADELPHIA 7, PENNSYLVANIA
725 Widener Building

LORD MANUFACTURING COMPANY • ERIE, PA.

LORD BONDED RUBBER

Headquarters for
VIBRATION CONTROL

i.e.r.c. heat-dissipating miniature

TUBE CLAMPING SHIELDS
give *lower* bulb temperatures and *increased* tube reliability!

I.E.R.C. tube clamping shields solve electron tube heat and vibration problems. Temperature reduction is made possible by conducting heat directly from bulb to the chassis or heat sink providing greater reliability.

Tested, Proven, Accepted... AVAILABLE!

I.E.R.C. shields will meet environmental requirements for present and future industrial and military electronic equipment.

International

WRITE TODAY! For complete information send inquiries to International Electronic Research Corporation, 175 West Magnolia Boulevard, Burbank, Calif.

electronic research corporation

ACCURACY • DEPENDABILITY • VERSATILITY

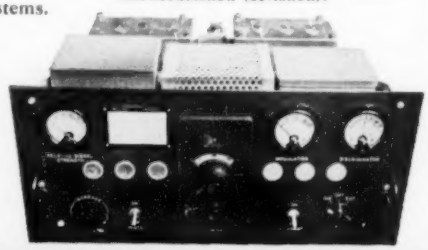
RREP 842-C FM RECEIVER

A double-conversion FM Receiver covering the 215 to 235 mcs band which meets the highest standards for quality, and including numerous special circuits to make tuning simple and positive and assure long, dependable operation.

This receiver forms an integral part of the RREP Telemetering system, where it is used to receive FM/FM signals in the 215-235 mcs range with a deviation of ±125 kcs, and to demodulate these signals for application to an amplifier, discriminator units, and/or recording systems. May be used similarly in Radio Control systems or in laboratories wherever accurate, dependable reception of FM signals in the 215-235 mcs range is required.

FEATURES

- Sensitivity—2.5 microvolts or better at center frequency, and 5 microvolts or better at ±150 kcs deviation.
- Signal-to-noise ratio of 60 db for 10 microvolts input at ±150 kcs deviation.
- Voltage-regulated B-plus circuits for Oscillator and Reactance Modulator.
- A.F.C. circuit maintains control up to ±800 kcs from mean set frequency based on a nominal deviation of ±125 kcs.
- Output signals flat within 0.5 db from 100 cps to 100 kcs.
- Three front panel meters—Discriminator Balance, Relative Signal Strength and Modulation (deviation).



RREP

RAYMOND ROSEN ENGINEERING PRODUCTS, Inc.
32nd & Walnut Streets • Philadelphia 4, Pa.

considerably among these airplanes. For example, the Beech Super 18 is powered with two Pratt & Whitney Aircraft R985-AN-14Bs that deliver 450 takeoff hp. at 2,300 rpm.

The Twin-Bonanza and Aero-Commander are both powered with 260-hp. geared Lycoming engines; the Cessna has two Continentals rated at 225 hp., and the Piper has two 150-hp. Lycomings.

Detailed specifications and performance data are given in the specification section of this issue.

►**Old Stand-Bys**—Despite the availability of these newer aircraft, the major portion of the twin-engine business fleet still is made up of the old stand-bys:

- **Douglas DC-3.**
- **Beechcraft 18.**
- **Lockheed Lodestar 18.**

Remainder of the group is made up largely of converted World-War-II bombers, such as the Douglas A-26 and B-23, Martin B-26 and North American B-25J. Grumman's Widgeon and Mallard, and Lockheed's PV-1 Ventura round out the twin-engine picture, with the exception of a few Convair 240s and 340s used by some of the larger corporations.

►**Single-Engine Aircraft**—The single-engine plane has found widespread application in business flying among smaller companies and individual businessmen who fly themselves. Economy of operation is the big feature.

And there's no shortage of suitable models, either. Unlike the twin-engine owner, single-engine users have a wide variety of modern types from which to choose.

Leaders in this field are the new four-place Beech Bonanza E35, the Piper Pacer and Tri-Pacer, and the Cessna 170 and 190-195 series. Orders are heavy for all of these planes, indicating a high degree of satisfaction with present single-engine equipment.

►**Facts and Figures**—Because of the scarcity of reliable statistics on business flying, it is difficult to obtain a composite picture of the field as a whole—i.e. total number of aircraft currently in operation, percentage of twin- and single-engine planes, number of hours logged, total number of hours flown, etc.

Almost all data currently being circulated is put out by the Civil Aeronautics Administration, and, by CAA's own admission, it is far from accurate.

But, in the absence of facts and figures from other sources, it is all the industry has to go on. Every year, CAA compiles a set of statistics on business flying for the previous year. Such information could be invaluable to operators, manufacturers and all other interested parties, but it has these drawbacks:

- It is published anywhere from 12 to

■ BUSINESS FLYING

14 months after close of the year for which data has been compiled (1952 report came out in February 1954).

• It is compiled in such a way as to leave more than a reasonable margin for error and inaccuracy.

►**CAA's Yardsticks**—A typical CAA study lists "inactive" as well as active business aircraft. In many cases, these inactive planes have not flown in several years, but because they are still listed in CAA records as business aircraft they are included in the overall total. In the published figures, however, no differentiation is made between inactive and active planes. As a result, the totals can be off by a wide percentage.

Questionnaires are sent to owners in March or April of the year being surveyed, requesting an estimate of the number of hours that will be devoted to business flying during the year. CAA publishes the total of these estimates as the actual "number of hours flown" for that year.

Many planes are used for combination business and pleasure. In its published reports, CAA lists total number of hours flown by these planes under business flying. This same total is repeated in the section for pleasure flying. No division is made or estimated between the two.

All of these figures receive wide distribution. In the absence of more accurate data, they are relied upon by all operators, potential operators and manufacturers for planning purposes. They constitute the only yardstick currently in existence by which the growth of business flying can be measured.

Possibly CAA may streamline its methods in the future. But, for the present, officials say economy and lack of adequate personnel and facilities prevent a more comprehensive study of the situation.

►**Figures for 1952**—Latest CAA study was released last month for business flying in 1952. Here are the figures:

• Hours flown were 3,124,000, almost three times the flight hours recorded for 1946.

• Miles flown increased 11% over 1951.

• "In 1952, general aviation business flying exceeded the revenue hours of the scheduled domestic carriers by some 600,000 hr."

• Total of 30,500 aircraft was engaged in business flying during 1952 (not all exclusively business aircraft).

• Some 11,100 company-owned aircraft engaged in business flying in 1952.

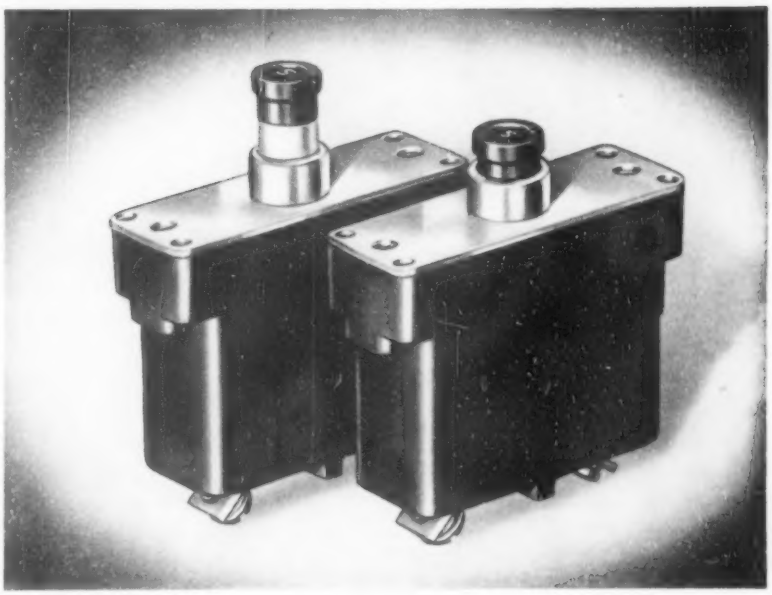
• Individually owned aircraft engaged in business flying numbered 19,400.

Greatest utilization of business aircraft was registered by the petroleum industry, says CAA, with manufacturing and mining industries running close behind. —FS

PROTECTION PERFORMANCE Assured

Is Manual Switching your problem?

KLIXON D-6752 CIRCUIT BREAKERS Withstand over 10,000 Manual Cycles with Load!



Here's a circuit breaker that gives positive circuit protection over years of operation. This design is the only push-pull, trip-free unit that can be cycled manually several thousand times with or without load without significant change in calibration.

Field reports indicate that many circuit breaker designs which require movement of the bi-metal element for unlatching change calibration even when cycled a few hundred times without load — *the D-6752 has a special latching mechanism which prevents this calibration change.*

Like all Klixon Circuit Breakers, the D-6752 is individually calibrated and inspected for ultimate trip and high overload tripping, assuring accurate, dependable protection under all flight conditions.

Write for specification data which gives complete information.

SPENCER THERMOSTAT
Division of Metals & Controls Corporation
2803 FOREST ST., ATTLEBORO, MASS.

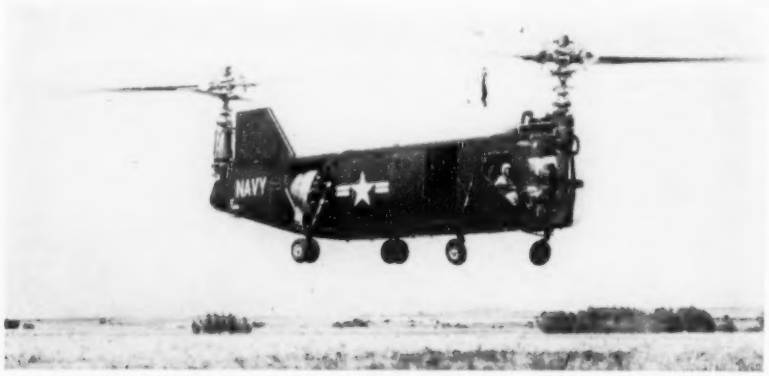
KLIXON

■ HELICOPTERS

Military Copter Success Spurs Civil Use

By Irving Stone

Today's copter is far from perfect, but it surely is in business. It is still the product of a relatively young art, but the industry and the public today are more conscious of rotary-wing craft than ever before.



BELL XHSL-1

SIKORSKY XHR2S-1

Service experience has demonstrated unmistakably what the craft can do. And the coming era of the copter may usher in a greater collaboration between military and civil users than ever before experienced in aeronautical circles. This can bring far-reaching benefits to the industry in general by cutting down the problems involved in the transition of a military design to civil application.

Anticipating a burgeoning transport era, airline interest is quickening—transportation executives already are in discussion with the major producers of helicopters. This doesn't mean that the present types of copters won't be with us for a long time. They will, but interest is centered not only on existing types but on those in the far-ahead planning stages as well.

Interest in the machine itself isn't the only facet which has been accelerated. Heliport planning also is underway, with ideas being contributed by municipalities, operators and manufacturers alike.

▶ **"Different Beast"**—Too frequently the rotary-wing craft is compared with its fixed-wing counterpart—on the basis of cost, speed, range, and cargo- and passenger-carrying capacities—yet often it isn't realized that the copter is a "different kind of beast."

It has unique characteristics and must be justified on this ground alone. Whether you look at it from the viewpoint of cost or performance, there's a price to pay for the ability to hang in the air, go up or down or forward or backward at will—things the conventional plane can't do.

PIASECKI YH-16

Big operational dividends over and above the copter's basic characteristics will come as engineering refines the machine. Meanwhile, it is going to take a lot of effort to build into the copter a performance comparable to that of the fixed wing—if this ever can be achieved.

► **Korea's Value**—Military experience, highlighted particularly by Korean theatre operations, although conducted with copters not exactly embodying what was wanted, has gone far to define the usefulness of the copter, pointing the way to abilities it is expected to have.

International emergencies confronting the military have made available readily the development and production money to bring out copters embodying accelerated progress.

Civil operations, particularly those of the local pioneering airways, even now are showing the way to future copter potentials—and requirements.

Where We Stand

At the present reading, it looks as if copter development will parallel, in general aspects, the development history of fixed-wing aircraft.

With the copter's definitely different flying characteristics firmly established and its usefulness emphatically demonstrated, next big factor concerning the designers will be what form the future transport rotary wing aircraft will take—what will be the "optimized" copter, what sort of best "standard?"

► **Growing Up**—In this respect, development still has not reached a status comparable to the early fixed-wing transport such as the Douglas DC-3. A glance at a yearbook for aircraft of the late 1920s discloses the various configurations of the fixed-wing planes of that era. This, approximately, is the comparative stage in which the copter now finds itself configuration-wise.

Despite the pronounced variations in present-day rotor systems and other rotary-wing details, indications are that the copter definitely is on the path to an optimum configuration. But know-how for this optimization process apparently still is not sufficient. How soon this degree of information will be achieved depends, in the main, upon the effort expended. Pressure for this effort may well be stepped up by increasing airline interest and studies aimed at copters for various route jobs.

It is likely that, in the not-too-far future, the industry will see the better designs survive, followed by research and redesign leading to at least two copter configurations generally accepted as standard for large-scale transport use. The reason two types will have to emerge is that there will be two general categories of service—a metropolitan or

KAMAN HOK-1

DOMAN YH-31

intra-city run and the longer-hop inter-city service.

▶**Good Base**—The move forward for copter development has an excellent base from which to work. Structures are good, rotor head problems in a large measure have been solved, and the all-metal blade, with its excellent characteristics for thermal anti-icing as an aid to all-weather operations, has carved a place for itself.

More powerplant types from which to draw are coming into the picture. While the turbine appears as a promising contender, it will have to be researched and tailored for its specific job.

▶**Small Staffs**—Many of the progress factors already chalked up for the copter probably would have been better if rotary-wing companies had engineering staffs comparable to those found among the large fixed-wing airframe manufacturers. One of the latter might easily siphon off 20 or more men for some miscellaneous job, but the loss of this number, even on a short-term basis, would make a serious dent in the creative output of a relatively small rotary-wing builder.

Some comparatively big problems remain. Some of the more pressing ones which must be researched in copter development involve stability, high-speed rotors, vibration, fatigue, and gearing and bearing considerations.

The prospective civil users of copters have had their initial thinking fired by realization of what the helicopter can offer in numerous fields of use.

In addition to the firmly established utility category, the immediate future expansion now seems to have boiled down to the transport and executive-type categories. None of the industry members now building copters consider that the copter will be the average man's aircraft in the near future.

Executive Copters

The executive-type copter is expected to create its own market, opening a broad new field. In many instances, fixed-wing executive craft do not offer much convenience over scheduled air transport, whereas the copter will be able to carry the executive from plant-to-plant sites in industrial areas.

Initially, because of cost and maintenance factors, it is likely that executive-type copters will find application with the big companies, first used by those which already utilize fixed-wing craft.

▶**Utility, Too**—The executive type also will double in the utility category, and ranging from three to eight places will fill a category now in greatest demand in the export market. As an example of the magnitude of the export market, 46% of Bell's Model 47 copter commercial sales finds its way into this outlet.

In the domestic market, uses for the executive-utility copter loom big. Even now, 54% of Bell's total domestic sales (U. S., Canada and Alaska) are split into these specialized operations—construction (14%), training (10%), air-mail (8%), local government (6%), ranching (4%), petroleum (22%), utilities (19%), national governments, exclusive of military (10%), overlapping functions (4%), and executive transport (7%). Industry observers see a big expansion in the latter category.

In the production of the small-type copter, as opposed to the transport type, Kaman and Cessna probably will emerge as first-line contenders, in addition to those already established in the field.

▶**Cessna Contender**—Cessna, now flying a four-place rotary-wing craft preparatory to certification stages, will go into production this year if present plans go through.

This four-placer is aimed directly at the executive and military market—the company has no intention of getting into the transport field. This is considered a smart attitude, for the company is simply adding another product to its existing line. Cessna is one of the companies in the enviable position of having its fixed-wing sales setups already established. Marketing the copter should be no additional burden.

JACOBS 104

Transport Copters

Building copters for the transport category, Sikorsky, Piasecki and Bell are

HILLER YHJ-1

going to be the big factors, although some of the major manufacturers of fixed-wing aircraft are interested in the market prospects. Douglas, for one, has had the intercity copter under consideration for a considerable time and has a design team organized for specific work. Fairchild, too, is said to have a keen interest in the field.

▶ **Sikorsky**—Sikorsky's 10-place S-55, although performing yeoman service for New York Airways, Los Angeles Airways, and Sabena in Belgium, in what are pioneering copter transport efforts, is considered too small for transport operations now envisioned.

Sikorsky's S-56, civil version of the HR2S—the latest copter to make its debut for military (Marine Corps) work—is scheduled for commercial availability in about two years, subject to Marine Corps approval. This is sooner than was anticipated. It will be offered as a 30-place copter, although it would accommodate 35 for short hops. It constitutes an excellent base for future development in the copter transport field. Its speed, first reported at about 150 mph. cruise and about 175 mph. top, is now said to be about 25 mph. more for each condition.

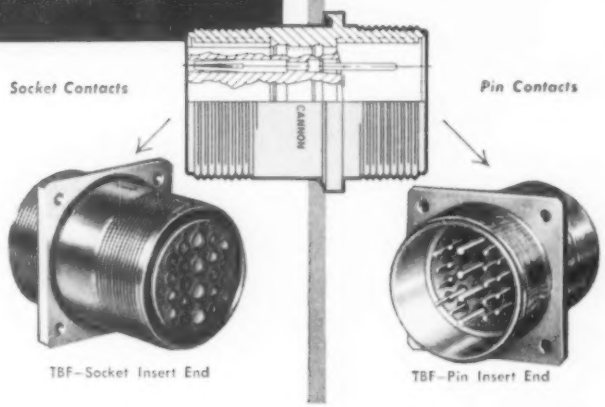
The next copter to be offered by Sikorsky will be a 50-place job, initially developed for the military, later slated for civil use.

▶ **Piasecki**—Piasecki's H-21B could accommodate about 20 passengers. It has been in volume production for a considerable period for the military. Powered by a single engine, cruising speed of the craft is in the neighborhood of 100 mph.

Another Piasecki contender for the near future is its giant H-16 Transporter. Two verisons of the craft are in the works—one with two P&WA R2180 piston engines, another with two Allison T38 turbines. A relatively speedy copter, the Transporter will accommodate 48 to 72 passengers, although it more likely will emerge along

CANNON *bulkhead* **RECEPTACLES**

fewer parts... save wiring... less trouble



positive protection and convenience

The Cannon units shown here permit you to handle aircraft pressure-problem bulkhead connections with single pre-assembled units . . . connections to bulkhead mounted apparatus, or connections through bulkhead. And, you don't have to assemble separate parts. You get them complete, with less parts, easy to install, easy mating, easy to maintain.

with "Double-Faced" inserts... pins one side... sockets other side

The TBF . . . Pin and socket contact construction. Seven shell sizes. Seventeen sealed, resilient "AN" inserts. Leakage not over 1 cu. in. air per hr. when subject to 30 psi differential. #16 and #12 contacts. Cable components may be bench wired, tested in the shop, merely plugged in to complete the job. Special sealing ring prevents bulkhead mounting leakage.

BFP and BFR Pressurized Bulkhead Receptacle

with "Single-Faced" pin inserts

The BFP . . . Withstands differential pressure of one atmosphere. Pressurized "AN" inserts of *plastic material*. 12 shell sizes. 15 inserts.

The BFR . . . *Resilient material inserts*. 12 shell sizes. 15 inserts.

Front view Rear view

and the ALL-NEW TBF-K with "Double-Faced" pin inserts

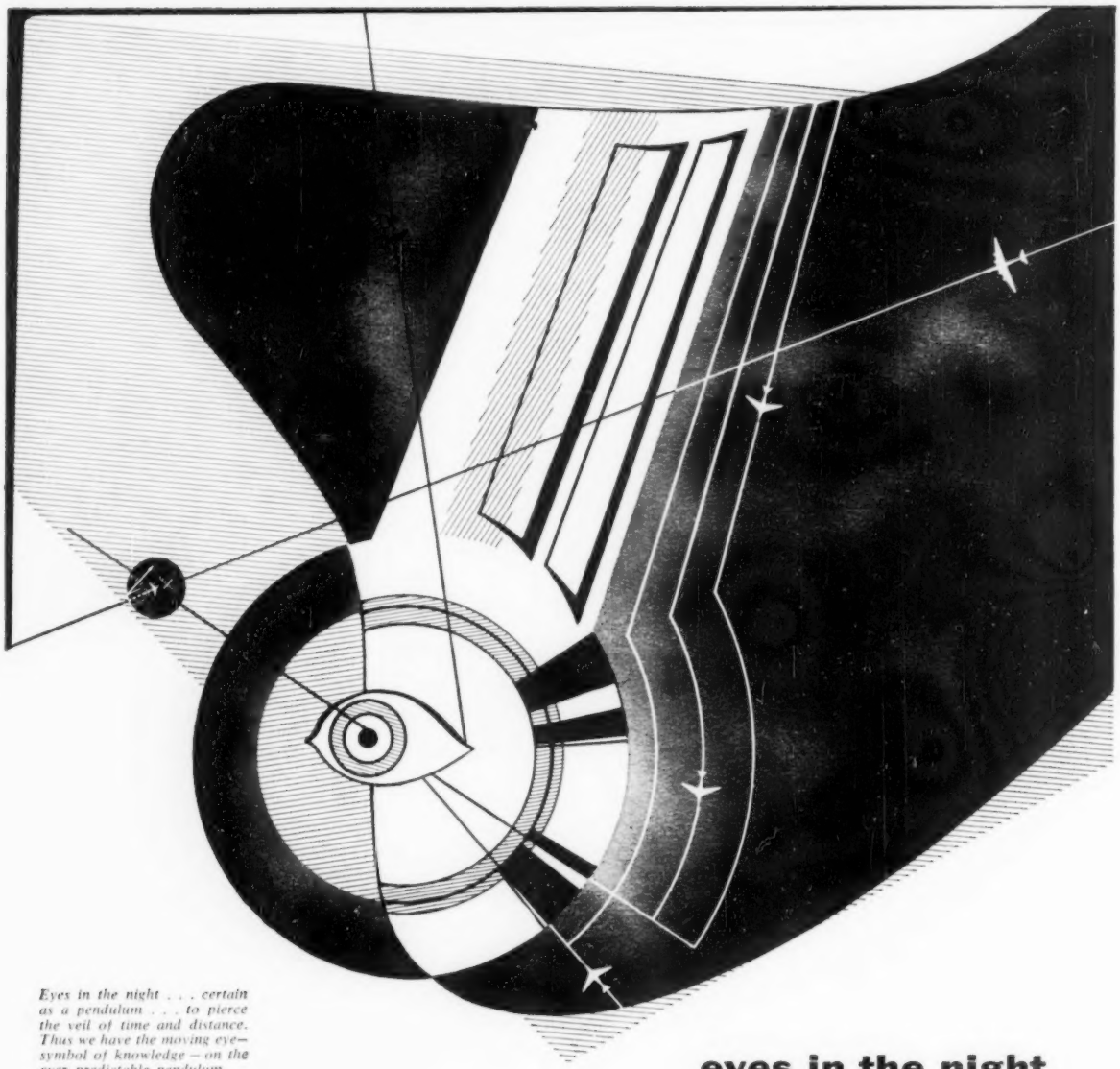
The Cannon TBF-K is *all new* . . . and another Cannon *FIRST!* Pin inserts in *both* sides. Quick disconnect. Single piece shell. 5 standard Cannon "K" inserts. Adaptable to aircraft bulkheads and other commercial uses.

Write for Cannon Electric Bulletins . . . NOW! Cannon Electric Company, 3209 Humboldt Street, Los Angeles 31, California. Factories in Los Angeles; New Haven; Toronto, Canada; London, England. Representatives in all principal cities.

Refer to Dept. 110

CANNON ELECTRIC

Since 1915



Eyes in the night . . . certain as a pendulum . . . to pierce the veil of time and distance. Thus we have the moving eye—symbol of knowledge—on the ever predictable pendulum.

eyes in the night

The victory over time and darkness is certain with Kollsman instruments. Certain because of our quarter century dedication to accuracy in controls and instrumentation.

Today our activities encompass four fields:

AIRCRAFT INSTRUMENTS AND CONTROLS
OPTICAL PARTS AND DEVICES
MINIATURE AC MOTORS
RADIO COMMUNICATIONS AND NAVIGATION EQUIPMENT

Our manufacturing and research facilities . . . our skills and talents, are available to those seeking solutions to instrumentation and control problems.

kollsman INSTRUMENT CORP.

ELMHURST, NEW YORK • GLENDALE, CALIFORNIA • SUBSIDIARY OF *Standard* COIL PRODUCTS CO. INC.

the lower band of this capacity range.

Piasecki's craft are tandem-rotor configurations, as opposed to Sikorsky's commitment to single-rotor jobs. Opinion is divided as to which arrangement is better. The single rotor is lighter than a dual or tandem arrangement, involves less complication. On the other hand, the tandem allows greater center-of-gravity flexibility—an important load-placement feature for both military and commercial operations. The CG travel on Piasecki's YH-16 exceeds that in any other aircraft.

▶ **Bell**—Bell Aircraft also favors the tandem configuration for large machines. It now has both single and tandem arrangements in production.

Bell's present prospect for the transport field would be a civil version of its XHSL-1 Navy copter. The commercial craft would accommodate about 16 passengers. Powered by a P&WA R2800 engine, the configuration embodies twin rotors with two blades each. This craft is another prospect for commercial availability in 1956.

▶ **Compound Copters**—The compound helicopter—a combination of the conventional copter plus additional engine-propeller units carried on stub wings—also is in the picture for future intercity transports.

The Gydrodyne Co. of America has a copter of this type in the design stage. It embodies counter-rotating coaxial rotors, plus stub-wing-carried powerplants driving counter-rotating props.

▶ **All-Weather Operation**—Looming as a large factor in the copter transport scheme is the need for full realization of all-weather operation with rotary-wing aircraft.

Airlines probably would take delivery of copters prior to perfection of all-weather characteristics, but the prospects are that, in view of the strides being made in that direction, the problem may be fully solved when the planned commercial copters are ready for the market.

▶ **How About Noise?**—A vital consideration affecting transport copter operation is the external noise problem. Soundproofing will take care of internal noise.

Where the copter is used in remote operations, noise has been no major factor. As it comes into the metropolitan areas, the copter noise problem poses difficulty. Even now, with an S-55 transport, New York Airways' flight path between Idlewild and Newark airport stretches 29 mi., because of noise and safety reasons, instead of the 21-mi. direct line route.

With the copter, about 90% of the total noise comes from the engine exhaust, it is estimated. Muffling this noise appears as a solution, but effect of muffling may make it necessary to go up in horsepower and also bring in additional weight. Gas turbine engines in copters will lessen the noise.

▶ **Waterway Routes**—In any event, the copter's superior maneuverability and slow-speed and low-altitude capabilities will make it possible to follow a winding approach path where noise may not prove too much of a disturbing factor. These paths might be highway trunks, railroad lines and waterways.

A large percentage of big cities are on waterways, and these frequently run close to the heart of the city. Thus, waterways not only offer a means of approach but also suggest themselves as advantageous sites for heliports.

▶ **Heliport Planning**—Even though heliport questions are far from being resolved, there is a distinct consciousness that it is only a matter of a short time before "city-center" copter takeoff and letdown sites will have to draw close attention. Airport planners already are preparing to meet the condition.

As an example, the budget for a new large airport already is being reexamined because of the expected effect of short-haul and 200-300 mi. copter traffic

AVIATION FABRICS
to Specification
"FROG" BRAND
by Sawyer
COATED FABRICS
For . . . the fabrication of canopy covers
. . . interior trim
. . . insulation
Vinyl-coated Cottons—Nylons—Fiberglas—and other Synthetics
Made to your specifications. Manufactured in all types, colors, weights and widths to government and AAF specifications. Contact your nearest representative or write us for samples.
NEW YORK: Walter I. Schutt, 18 East 41st St., MUrray Hill 5-3611
William E. Mitchell, 15 West 26th St., MUrray Hill 6-8750
ATLANTA: Maurice E. Woods Co., 83 Cain St., N. E., CYpress 4218
CHICAGO: D. Russell & Co., 331 South Peoria St., TAylor 9-7471
DALLAS: W. L. Mellor Co., 1507 Dragon St., RAndolph 8479
DETROIT: J. L. Gibson, 1116 Beechmont Dr., Dearborn, LOgan 1-2484
KANSAS CITY: W. L. Mellor Co., 2603 Warwick, GRand 6850
LOS ANGELES: John Sweeten, 516 South St., Andrews Pl., DUnkirk 7-2587
SEATTLE: R. C. King, Inc., 117 Madison St., Seneca 1740
THE H. M. SAWYER & SON CO. Established 1840
Coated Fabrics Division
Watertown 72, Mass. WAtertown 4-0520

need relays?

Potter & Brumfield is your BEST SOURCE for CUSTOM-BUILT RELAYS

here's why!

Design

Fast, accurate development of relays and small electro-mechanical assemblies to exact military or industrial specifications.

Engineering

Extensive research, laboratory and model shop facilities available to help solve design engineers' most complex relay problems.

Manufacturing

Three large, fully equipped plants geared to meet today's rigid production requirements . . . single shift capacity of 10,000 relays per day!

- Samples, Recommendations and Quotations on Request.
- P & B Sales Engineers in Principal U. S. and Canadian Cities.
- Write for Master Catalog Showing Full Line of Basic Structures.
- Standard Relays Available At Your Electronic Parts Distributor.

Potter & Brumfield
PRINCETON, INDIANA
Export: 13 E. 40th St., N. Y., N. Y.

SIKORSKY H-19

being diverted to "downtown" facilities. The budget was projected to take care of the city's airport needs until 1970. Now planners believe that by 1960, about 40% of the traffic will be copter travel. For this reason, a substantial portion is being planned for allocation to a heliport site.

Transport Speeds

General requirements have not yet jelled for copters to emerge within the next few years. Discussions have been on a preliminary basis and have covered the subject in broad terms—from speed and range ideas down to such details as seats and windows.

▶ **Speed**—Speed capability of about 130 mph. for the metropolitan (intracity) operation copter and a 150-200-mph. figure for the intercity type have been mentioned as feasible. A compound-type copter transport might boost the speed value to 250 mph. or more.

However, specific high speeds aren't seen as too vital a factor because the copter won't have much trouble bettering city center-to-city center times associated with fixed-wing planes for the same route.

▶ **Capacity**—Opinions variously indicate that not less than 30 or 35 passengers would have to be accommodated in the intercity type, with higher limit estimates ranging from 40 to 50.

For the metropolitan-service type, estimates indicate 14- to 20-seat types.

▶ **Range**—Fuel ranges of 200-250 mi. for full gross are seen necessary by some in airline circles. There is opinion that the 200-mi. figure is too high, while others boost the upper figure to 300 mi. with a maximum payload plus sufficient fuel reserve.

Metropolitan operators would consider these general estimates too high for their requirements, which might economically fall in a stage length under 75 mi.

▶ **Engines**—Multi-engine power seems to have received the nod. Engine failure operation conditions still have not been pinpointed—whether hovering or climb-forward flight considerations will prevail.

Transport copters will carry retractable gear, and the folding blade will be an advantageous feature to make the most of hangar space for copter storage and overhaul work.

Military Experience

Until the expansion in civil transport copter operation really gets underway, the military will continue as a main medium to probe and further uncover

PIASECKI H-21A

2,000 HOURS

between engine overhauls

DELTA-C&S

FOR THE FIRST TIME in the history of the industry, the CAA has approved a 2,000-hour engine overhaul period. This authority has now been given to Delta—C & S for its Curtiss-Wright C18BD1 engines used in its Lockheed Constellations.

This new world standard of engine reliability is a tribute to the engine overhaul, line maintenance and flight personnel of Delta—C & S.

AeroShell Oil 120 is used exclusively in these Delta—C & S engines.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL®

Specify
STRATOFLEX
DETACHABLE HOSE FITTINGS
AND FLEXIBLE HOSE ASSEMBLIES

QUALITY PRODUCTS
DEPENDABLE SERVICE

WRITE FOR COMPLETE INFORMATION

STRATOFLEX

STRATOFLEX, INC. - FORT WORTH, TEXAS
P.O. BOX 10398

BRANCHES:
ATLANTA - CHICAGO - DAYTON - HOUSTON - KANSAS CITY - LOS ANGELES - MINNEAPOLIS
NEW YORK - ODESSA - TULSA
IN CANADA: STRATOFLEX OF CANADA, INC. - TORONTO 18, ONTARIO

the numerous possibilities of rotary-wing aircraft.

What the military already has done gives only an indication of uses ahead. Marine Corps experience is a good example of what already has been accomplished and what is looked for with the helicopter.

► **Landing the Troops**—With the advent of the atom bomb it was realized that there would have to be a new approach to putting troops ashort from ships which would have to stay farther out at sea and be more widely dispersed.

Operational studies of this concept were begun back in 1947 with the Sikorsky HO3S, even though it wasn't considered to be the specific tool for the job. (It was about this time that requirements were talked up looking to a copter of the Sikorsky XHR2S type.)

The Piasecki HRPs also were used as an interim vehicle, with great effect.

► **Mountain Supply Line**—The first real combat employment of a copter came in Korea with the Sikorsky HRS, in September 1951. Marines look at the occasion as a history maker. One copter squadron was attached to the 1st Marine Division. Three days later the division was locked in its heaviest fighting, in the mountains. Supply became an almost insuperable problem—the 2,500 native bearers couldn't bring up the minimum supplies required.

The copter squadron did the job admirably. It is now revealed that in supplying two regiments for five days it averaged 322,461 lb. per day, 31,589 lb. per hr., with an average load of about 909 lb. About 326 loads were carried per day (actually flights per day), and roundtrip time was about 20 min. About 10 copters are reported to have participated.

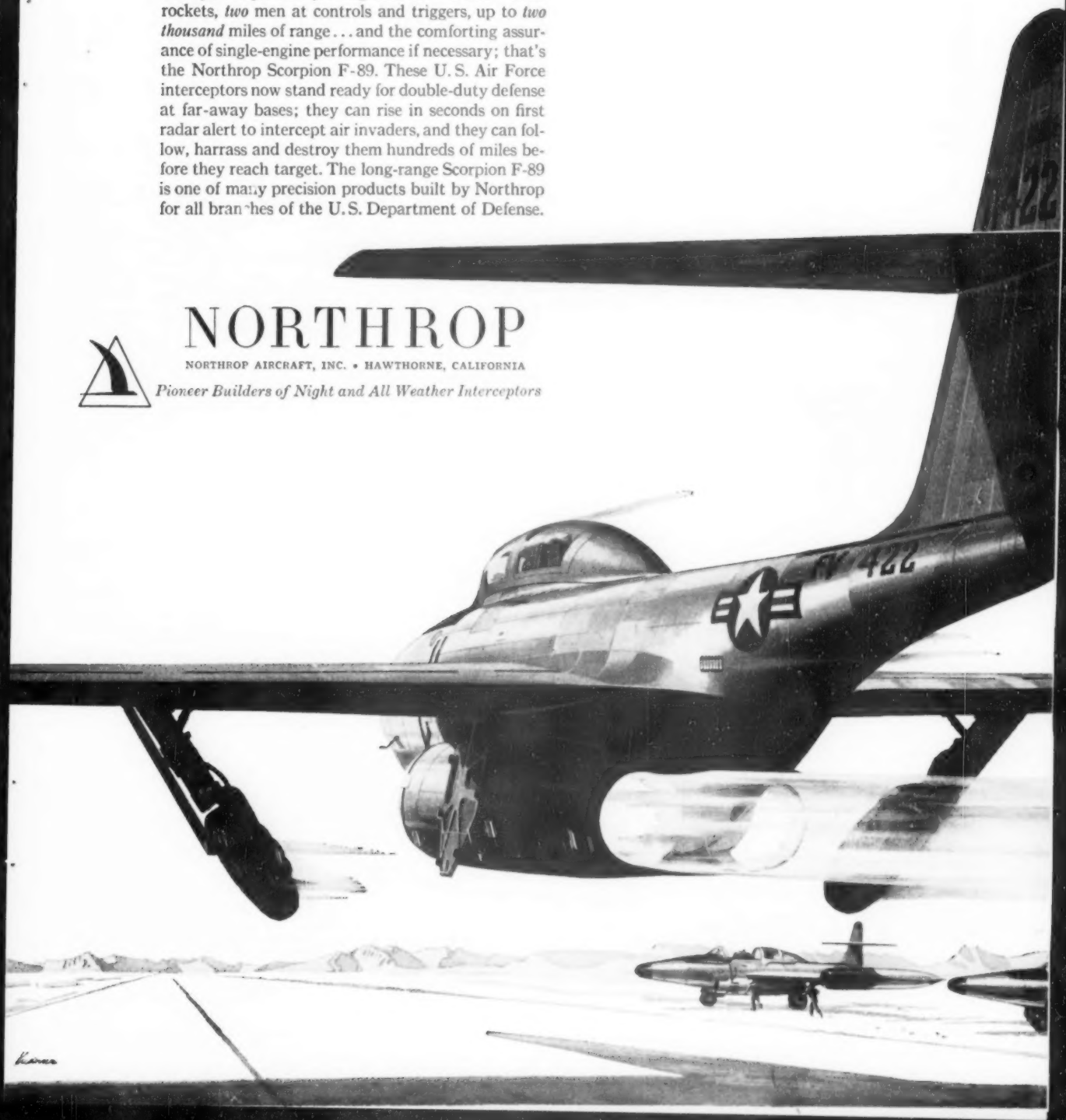
Following this the squadron was engaged in other large-scale supply operations, evacuations and troop movements, even at night, displaying a flexibility that no unit had ever known before. Since then, the Marines have been learning more and more about how the copter fits into the tactical scheme, engaging in many ship-to-shore operations.

► **Dreams Come True**—As developed for the Marine Corps, the Sikorsky XHR2S is just what this service arm had been dreaming about. It has more power than can now be utilized and the R2800s can be souped up to meet extreme operational requirements. Aim wasn't to get the fastest copter—the speed obtained is considered a dividend over and above the requirements laid down.

The Marine Corps could not use efficiently a larger copter now. The HR2S was tailored size-wise to fit the

Double Barreled

Two power-packed jet engines, *two* "decks" of 52 rockets, *two* men at controls and triggers, up to *two thousand* miles of range... and the comforting assurance of single-engine performance if necessary; that's the Northrop Scorpion F-89. These U. S. Air Force interceptors now stand ready for double-duty defense at far-away bases; they can rise in seconds on first radar alert to intercept air invaders, and they can follow, harrass and destroy them hundreds of miles before they reach target. The long-range Scorpion F-89 is one of many precision products built by Northrop for all branches of the U.S. Department of Defense.



NORTHROP

NORTHROP AIRCRAFT, INC. • HAWTHORNE, CALIFORNIA

Pioneer Builders of Night and All Weather Interceptors

carriers which were expected to be used in transporting the copters to areas where they would be needed. Size of carrier elevators and hangar decks was the controlling factor.

Even so, there is an upper limit to the size an assault copter should attain, although this has not yet been resolved. A controlling consideration is that not too great a concentration of troops is considered advisable for initial assault—it would be analogous to putting too many eggs in one basket.

The HR2S will be pushed to its limit by the Marine Corps to forward all-weather flight development. This phase of operation has top priority in targets now under the sights. Other service arms using rotary-wing aircraft undoubtedly have the same attitude on the subject.

▶ **Pushing for Speed**—More speed for military copters is seen as a near-future target. This would permit more runs in a given length of time, regardless of the type of copter used—assault, transport, cargo. Faster runs would also decrease vulnerability.

Just how much of a speed jump is considered feasible is not clear, although today's copter speeds are considered comparatively low.

▶ **Raising the Lift**—The need for very-heavy-lift copters may be solved by tip-driven rotors, to eliminate shafting problems involved in delivering torque from internal engines.

Noise in these jet-tip-driven machines may be very disturbing factor as distinguished from the fixed-wing jet plane, where the noise is behind the pilot. In the tip-driven copter, the pilot is in the middle of a noise circle, which probably is most intense during hovering. This operational factor will require considerable study.

▶ **One-Man Copters**—The "individual" copter—a rotor-seat combination, or a strap-on arrangement—isn't seen as a promising military development of the future.

Even as a one-man job for infiltration, it does not appear feasible. This same operation could be accomplished more effectively and less dangerously with a two-place conventional copter as the put-down medium.

Convertiplanes

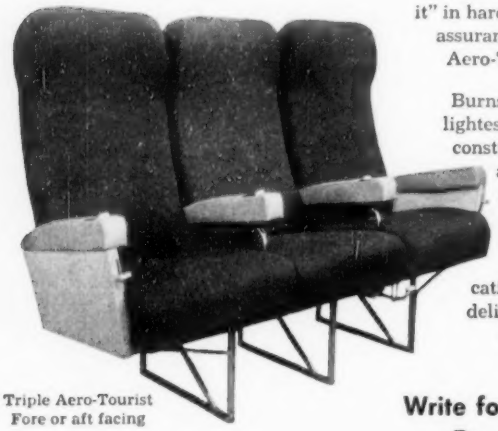
The convertiplane is thought of by some in the industry as the logical development or refinement of the copter—a sort of mongrel configuration embodying copter and fixed-wing characteristics, justified mainly on the basis of the increased level flight speed it promises over the pure copter.

A convertiplane speed of about 300-

BURNS AERO—Tourist Seats

Sturdy, handsome...and comfortable!

Passenger comfort and eye appeal... easy installation and the ability to "take it" in hard Air Tourist service—your assurance when you install Burns Aero-Tourist seating equipment!



Triple Aero-Tourist
Fore or aft facing

Burns Aero seats are among the lightest ever designed • CM steel construction keeps maintenance at a minimum • Contoured and cushioned for greatest comfort • Superb craftsmanship • Built to individual airline specifications • Prompt, *on-schedule* delivery • Burns Aero-Tourist seats are in airline service throughout the world.

Write for details—Airline or Executive aircraft seats.

BURNS AERO SEAT CO., INC.

3900 COHASSET STREET, P. O. BOX 127 • BURBANK, CALIFORNIA

ARE YOUR INSTRUMENTS *Breathless?*

Let them breathe again with VENTS of

Porous Stainless Steel or Porous Fluorocarbon Plastic or Porous Carbonyl Nickel

YOU GET

—rapid pressure equalization —hi-strength
—water repellancy —ease of mounting

Vent materials repel 2"—6 psi water pressure; up to 20 psi mercury pressure. State your requirements and recommendations will be made promptly without obligation.

For further information request Bulletin

Another engineered service in porous metals and plastics by

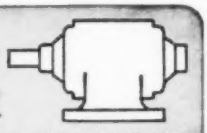
PALL

The Pall Filtration Companies

Micro Metallic Corporation | Porous Plastic Filter Co. | Aircraft Porous Media, Inc.

34-F Sea Cliff Avenue Glen Cove, N. Y.

MOST* MOTOR MANUFACTURERS use



PHOENIX *Brush Holders*

*Four out of five of the estimated total number of manufacturers of small electric motors in the United States!

Here's Why... Phoenix Brush Holders are standard components in hundreds of thousands of motors every year for two basic reasons: They uniformly meet exacting specifications; and they cost less than equivalent brush holders made by motor manufacturers themselves.

Get full details today on Phoenix Standardized Custom Service that puts precision mass production to work to cut your brush holder costs.

Write for Bulletin 54D

PHOENIX ELECTRIC MANUFACTURING CO.

711 WEST LAKE STREET • CHICAGO 6, ILL.

350 mph. would be very attractive for some operations.

Others do not see it fitting into the aerial picture at all—they say it is not practical as a copter or as a fixed-wing plane.

▶ **What Is It?**—The question frequently arises: "What is a convertiplane?" The definition necessarily must be loose and flexible and include aircraft embodying characteristics of both the copter and the fixed-wing configurations.

Those who draw a fine line of distinction contend that in a true convertiplane, initial vertical lift and the subsequent translational flight come from the same overall propulsive system. Where this vertical lift and forward propulsion come from separate systems, the aircraft frequently is called a compound type.

Generally speaking, the convertiplane is far behind the state of copter perfection development-wise—the two might not even be considered as being "in the same ball park." The convertiplane involves more detail than the copter, more gearing.

▶ **Not So Simple**—Whereas during conferences and on paper the convertiplane has been made to appear a relatively simple proposition, the effective accomplishment of such an aircraft is a tough problem even for such big and experienced builders as Bell and McDonnell. These companies, both engaged in prototype development, have copter and fixed-wing know-how; there is a good bit of each type in the convertiplane.

McDonnell's convertiplane prototype already has been unveiled (AVIATION WEEK Feb. 15, p. 17). It combines piston-propeller power with jet-driven rotor blades, has small wings.

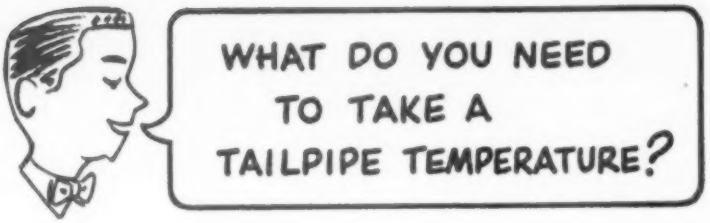
In contrast, the Bell convertiplane will feature large slow-turning rotor-propeller combinations swiveling on the wings, acting as rotors for takeoff and letdown, and as propellers when tilted forward for translational flight (AVIATION WEEK Jan. 25, p. 16). Because it is slated for the Army, it should emerge as a "workhorse" type.

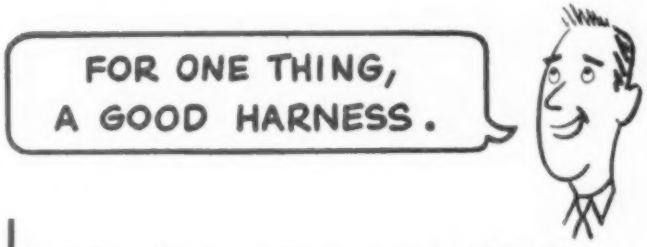
Indications are that windtunnel studies show that both Bell and McDonnell prototypes will have good performance.

For highspeed convertiplane applications, the jet powerplant is going to figure largely. One application seen as an efficient answer is a tip-mounted ducted fan, with the engine vertical for takeoff and rotated to horizontal position for translational flight.

The Navy, too, is interested in the convertiplane, may even own a piece of existing military contracts.

It will be a long time, development-wise before any commercial interest in the convertiplane is more than just casual—except, perhaps, for the compound type.



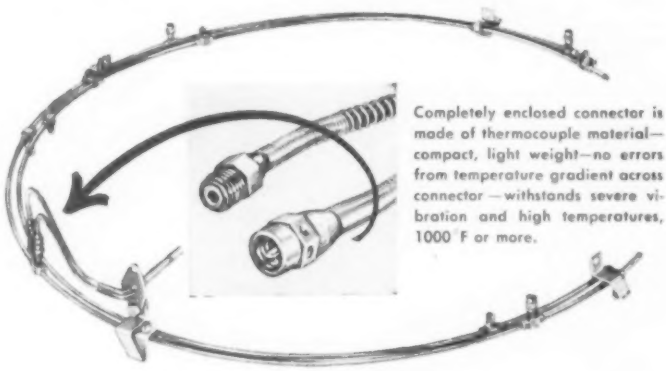


It's tough to take the temperature of a jet's tailpipe. Severe vibration and extreme changes in temperature can wreck measuring equipment. Yet, the information is vital to men who build the engines and fly the planes.

The harness used for the job must be rugged enough to survive brutal operating conditions (even more brutal now that engine thrust and temperatures are being increased).

T-E has several solutions to the problem, and the rigid, ladder-type harness shown below is one of them. Extension wire is protected from the heat, corrosion, and abrasion by one-piece, stainless jackets which are lined with ceramic insulation. Positive and negative conductors are jacketed separately for compactness and ease of installation. Harness can be equipped with open-end or stagnation thermocouples.

Briefly, it's a well-made harness that can take lots of punishment and high temperatures.



Completely enclosed connector is made of thermocouple material—compact, light weight—no errors from temperature gradient across connector—withstands severe vibration and high temperatures, 1000° F or more.

Get in touch with us. Let us help solve your temperature-measuring problems.

Pyrometers • Thermocouples • Protection Tubes • Quick-Coupling Connectors
Thermocouple and Extension Wires • Resistance Bulbs • Connector Panels

Thermo Electric Co., Inc.
SADDLE RIVER TOWNSHIP, ROCHELLE PARK POST OFFICE, NEW JERSEY
IN CANADA—THERMO ELECTRIC (Canada) Ltd., BRAMPTON, ONTARIO

BRUSHES
CONTACTS
SLIP RINGS
...AND SLIP RING ASSEMBLIES

BRUSHES — CONTACTS — ASSEMBLIES

...Use SILVER GRAPHALLOY for applications requiring low electrical noise; low and constant contact drop; high current density and minimum wear.

EXTENSIVELY USED IN:

SELSYNS • GUN FIRE CONTROLS
ROTATING THERMOCOUPLE and
STRAIN GAGE CIRCUITS
ROTATING JOINTS • DYNAMOTORS

Wide range of grades available for standard and special applications.

Other Graphalloy Products

Oil-free, self-lubricating Bushings and Bearings (applicable —100 to +300 F., with expansion coefficient half that of steel will not seize shaft at low temperatures); oil-free Piston Rings, Seal Rings, Thrust and Friction Washers, Pump Vanes.

GRAPHITE METALLIZING CORPORATION
1073 NEPPERHAN AVE. • Yonkers, New York

☐ Please send data on Graphalloy BRUSHES and CONTACTS.
☐ Send data on BUSHINGS.

NAME & TITLE
COMPANY
STREET
CITY ZONE STATE

Human Factors:

Man-Machine Teamwork Is Key To Best Use of Weapons Systems

Proper consideration of human factors can make the difference between success and failure of weapons systems which must be used and maintained by men.

If and when pushbutton warfare arrives, there will still be somebody who will push the button.

Somebody else will have to wire the circuits, somebody will have to maintain them, and somebody will have to think up improvements. Even if you don't carry this reasoning any further to include the people who design and produce pushbuttons and the people who hire and train those people, one very evident fact still stands out.

There will always be people.

This is the fundamental commandment in the study of human factors.

▶ **Basic Truth**—This simple statement has been around for some time, recognized to a greater or lesser degree.

But it has been only recently that aviation has begun to worry about the human factors relating men to the machines they fly in.

It has happened because man's evolutionary pattern has been outraced by the pace of technology during the past century. Today, in many cases, a military man can just about cope with the new conditions and artificial environment imposed by the weapons he is to use.

It is especially true in combat aircraft.

Look at a B-47 pilot, who senses through his hands and eyes and ears a precise flight path balanced on a knife-edge between highspeed buffet and low-speed stall. He is out of his element.

Without his pressurized cabin, his partial-pressure suit, his oxygen mask, he will die. Without a dark visor and non-reflective paint, he will go blind. Without self-confidence, training, a right frame of mind, he will break under the strain.

He lives in spite of being a human, not because he is. The gadgets that crowd his cockpit and chafe his hide, the escape and survival equipment under his buttocks, the psychiatric interviews and the medical reports will keep him alive.

That's one way to look at human factors work—as a study of the ways to keep a human alive.

Human factors endeavor falls generally in three broad areas: aero medical sciences, human engineering and human resources.

▶ **Aero Medical Sciences**—Aviation medicine is one specialized study among the many listed under this broad heading. The Aero Medical Laboratory at Wright Air Development Center of the USAF Air Research and Development Command has a project list which includes protective clothing of all types, inflight feeding, survival equipment, a resuscitator and a spray-on burn dressing.

The extreme variety of the list is a tipoff to the complexity of the aero medical job.

It wasn't always so. Primary effort used to center around the flight surgeon; his chief concern was preventing disease and curing sicknesses or healing injuries. Once in a while he was able to give psychiatric care, if he had the background and the available time.

Now a flight surgeon trains as if he were going to be a pilot; he frequently flies on training or routine missions with the men under his care.

There is considerable aero medical research directed towards methods of helping a man stay alive in the alien environment of the cockpit.

What effects do sonic and ultrasonic vibration frequencies have on pilots and ground crew? What is the toxicity of a new lubricant used in a jet engine, from whose compressor contaminated air may be bled into the cockpit? How old can a pilot get before he must be grounded?

These are some typical problems of the aero medical sciences.

▶ **Human Engineering**—Here the problem is to engineer the machine so that it can be operated by a human of normal dimensions and appendages.

Every engineer who has ever designed a plane or a component knows that once in his career he has called for a rivet where no human hand could hold a bucking bar to back up the rivet. Those same engineers have not had an awareness of the pilot's problems either. They have located switches in open locations where installation and maintenance was simple; the only trouble was that a pilot would need either a reverse-jointed arm, or a third arm to flip the switches.

Out of wartime cockpit engineering came many bitter experiences. One airplane had a gear-retraction lever in the

Look to THOMPSON *Aircraft Tire* CORPORATION

for the world's largest, most modern retreading facilities

Geared to handle volume retreading with greatest efficiency, Thompson Aircraft Tire Corporation has retreaded over 100,000 airplane tires for both the Military and nearly 100 world-wide airlines . . . more than all other retreaders.

MIAMI PLANT

TWO HUGE PLANTS

are strategically located in San Francisco and Miami. The most modern equipment, designed for all sizes of tires, is operated by expert workmen thoroughly trained in the exclusive Thompson techniques that are the product of years of pioneering and development of safe, superior retreading.

SAN FRANCISCO PLANT

Fast, dependable retreading service for any point on the globe from a Thompson plant

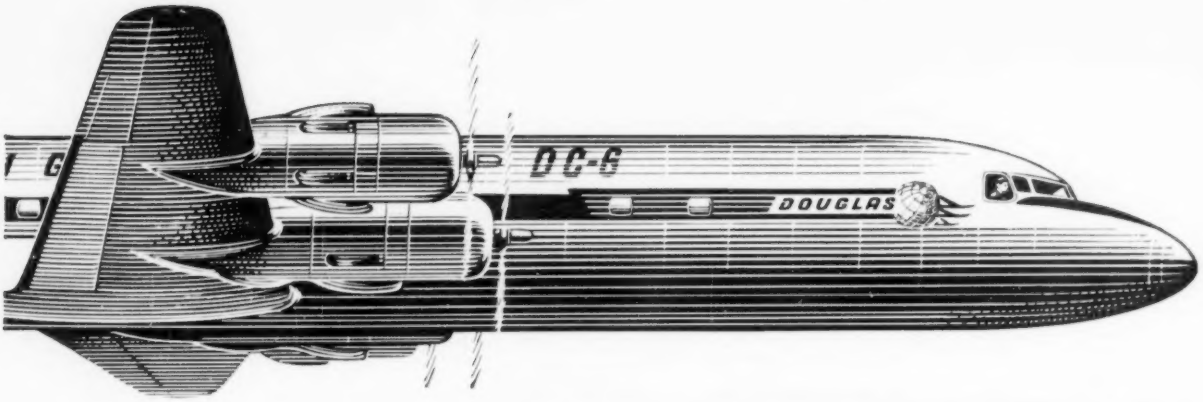
BY EVERY STANDARD, YOUR SELECTION OF THOMPSON *Aircraft Tire* CORPORATION FOR ALL OF YOUR RETREADING IS JUSTIFIED

THOMPSON *Aircraft Tire* CORPORATION

World's Largest Retreader of Airplane Tires

EASTERN PLANT
International Airport • Miami 48, Florida
Phone 88-1681

WESTERN PLANT
18th & Minnesota Sts. • San Francisco 7, Calif.
Mission 7-7320



IN TERMS OF PROFIT...

PERFORMANCE...COMFORT

THE GREATEST

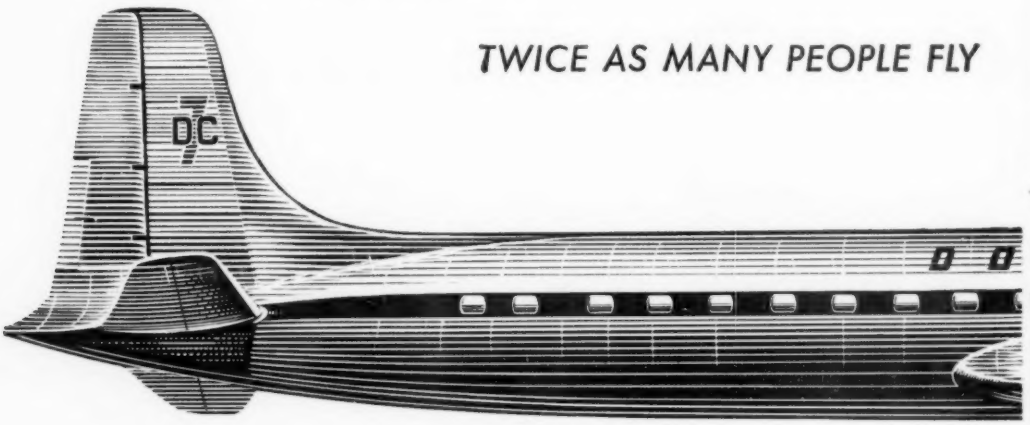
Latest model of the famed Douglas DC-6, the DC-6B represents the ultimate in this series of great, four-engine air transports. It was the DC-6B which flew 5700 miles from Los Angeles to Paris last May in 20 hours to complete the longest non-stop flight ever made by a commercial airliner. The superior performance of this airplane under all conditions and its acceptance by the flying public have established it as an outstanding profit-maker.

DC-6 SERIES

"Queen of the Fleet" on these leading airlines of the world is the famous Douglas DC-6 or DC-6B

AA *Argentine* • *AIGLE AZUR *French* • ALITALIA *Italian* • AMERICAN *U. S.* • ANA *Australian* • BCPA *Australian New Zealand* • BRANIFF *U. S.* CMA *Mexican* • *CGTA-AA *French* • CONTINENTAL *U. S.* • CPAL *Canadian* • DELTA-C&S *U. S.* • *EASTERN *U. S.* • FLYING TIGER *U. S.* JAL *Japanese* • KLM *Netherlands* • LAI *Italian* • *LAN *Chilean* • NATIONAL *U. S.* • *NORTH AMERICAN *U. S.* • NORTHWEST *U. S.* • PAL *Philippine* PANAGRA *U. S.* • PAN AMERICAN *U. S.* • SABENA *Belgian* • SAS *Danish Norwegian Swedish* • SLICK *U. S.* • SWISSAIR *Swiss* TAI *French* • UAT *French* • UNITED *U. S.* • WESTERN *U. S.* *Soon

TWICE AS MANY PEOPLE FLY



AIRLINERS EVER BUILT!

DC-7 SERIES

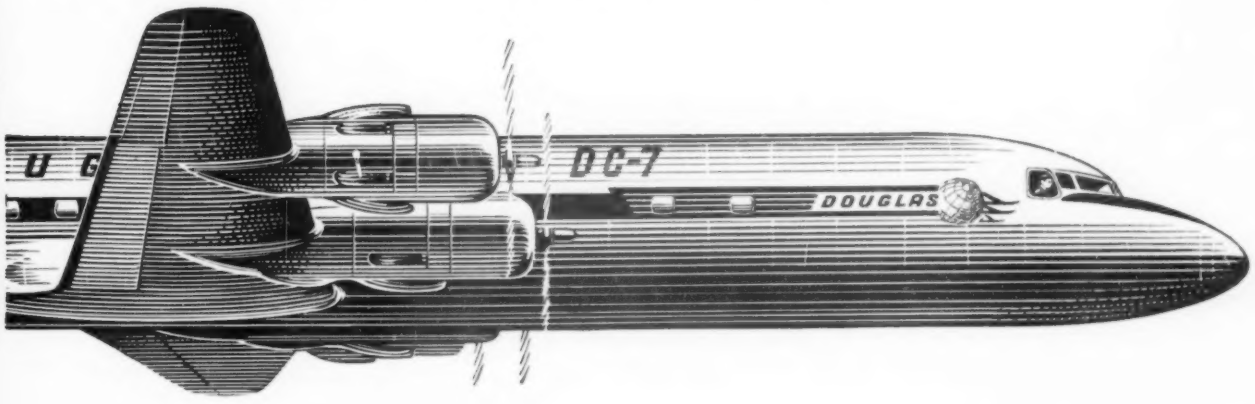
Already 88 of these new turbo-compound sky giants have been ordered by the airlines. This brings to a total of 476 the number of DC-6, DC-6B and DC-7 airplanes delivered by Douglas or under construction. So aerodynamically clean . . . so powerful is the DC-7 that it is the only commercial airliner making scheduled non-stop flights *both ways* across the United States. It is designed for maximum operating profits and to bring the air traveler comforts never possible before.

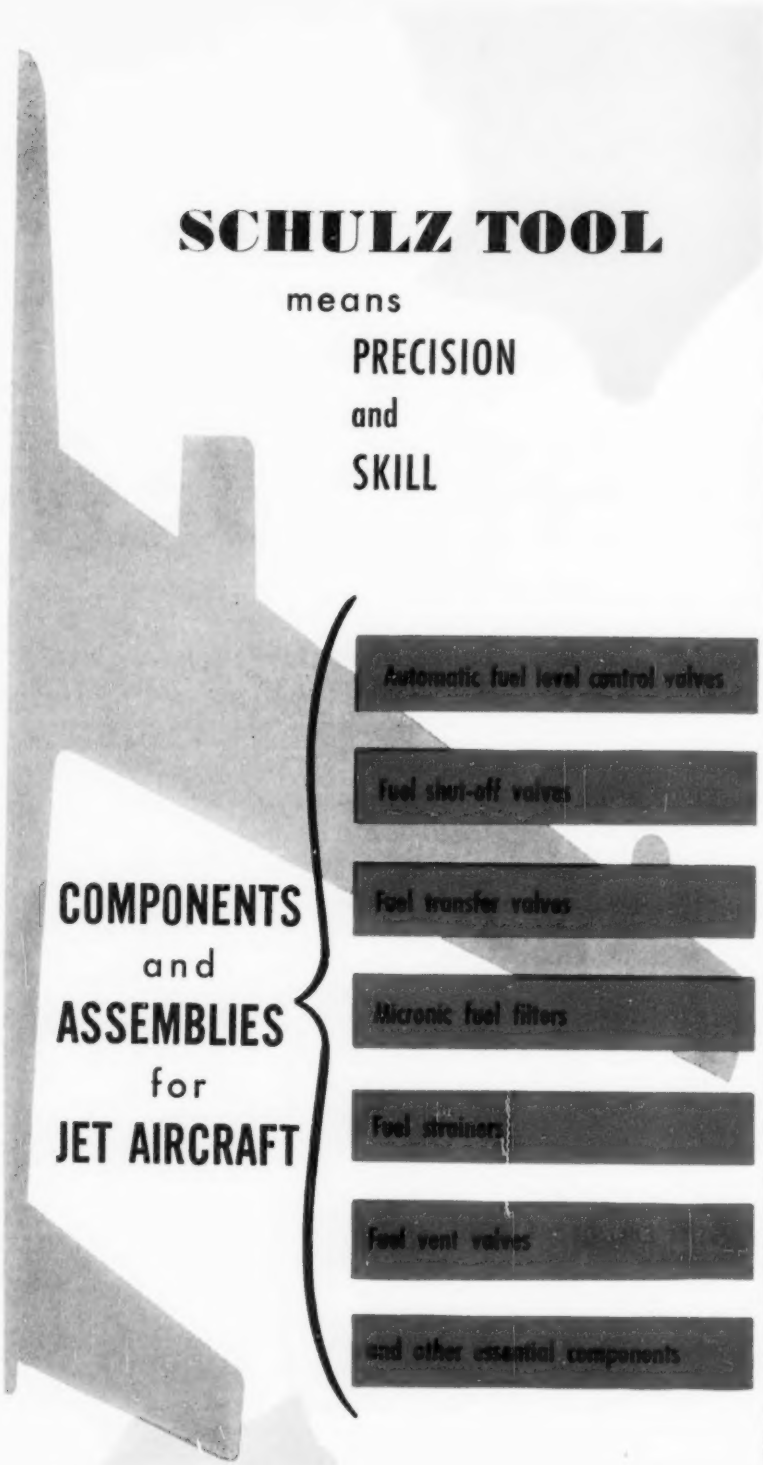
These airlines are flying or have ordered the luxurious new Douglas DC-7

AMERICAN AIRLINES • DELTA-C&S AIR LINES
EASTERN AIR LINES • NATIONAL AIRLINES
PAN AMERICAN AIRWAYS • PANAGRA
UNITED AIR LINES

DOUGLAS

DOUGLAS *AS ALL OTHER AIRPLANES COMBINED*





SCHULZ TOOL AND MANUFACTURING CO.

425 S. Pine St. San Gabriel, Calif.

identical spot where another had the tailwheel lock. A canopy release was on the left in one model; a later modification put it on the right.

Pilots would fly these types interchangeably; a high accident rate was the inevitable result.

Some observers of human engineering believe that the greatest single contribution of this phase of human factors is in the great advances made in standardized cockpit layout, control shapes and motions.

► **Human Resources**—This phase of human factors work considers the relation of the individual to his environment. Specifically, methods of selection of flying personnel, their training and promotion would be studied in this field.

But there is a broader aspect opening out of the relation between man and the world around him. The complexities of psychological warfare, the impact of nuclear weapons on a social or political group, the several phases of intelligence are all part of the human resources picture. So is group and individual morale.

So human factors in general can spill over into almost any line of endeavor, simply because the study is based on the fact that there'll always be people.

In the Air Force, three former ARDC human resources research units recently were integrated as the AF Personnel and Training Research Center.

Under one heading come these research laboratories, indicating the range and magnitude of human factors work in just one USAF command: Personnel Research and Skill Components Research; Aircraft Observer Research; Training Aids Research; Armament Systems Personnel Research; Crew Research; Basic Pilot Research; Interceptor Pilot Research; Officer Education Research.

It has taken designers and engineers a long time to realize that human limitations and frailties ultimately determine the effectiveness of hand-operated weapons. There is still considerable controversy between the proponents of pilot comfort and those who favor the Spartan approach. There are still those who believe that an aircraft technician is created by command and not by ability.

But the fact that there has been a continuing undercurrent of consideration of the human angle is encouraging. From first awareness of the problem, through initial exploratory contacts to partial understanding, the study of human factors has grown at an increasing rate.

It promises to be one of the most important phases of technology ever considered in aircraft research, development and design.

QUICK PICKUP!

with an Aircraft Hoist

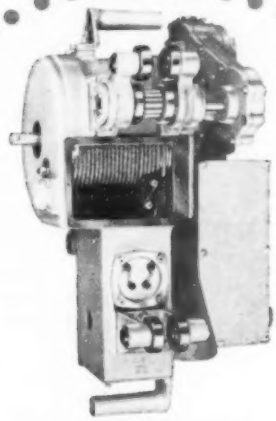
by BREEZE MARK

■ Whether you want to pick up a 160-lb. man or 10,000 lbs. of cargo, BREEZE can engineer the right strato-hoist for your needs.

We have developed a new line of cargo handling hoists and winches that offer the advantages of compactness and precision performance.

All feature a high rated load in relation to extremely light weight. All have special overload and safety features to meet the exacting standards of the advancing aircraft industry. For the newest in electrical, mechanical or hydraulic hoists, consult BREEZE engineers.

OUR SPECIALISTS ARE AT YOUR SERVICE.



CARGO HANDLING • TOWING
ENGINE CHANGING • RAMP OPERATING
RESCUE WORK • OTHER USES

BREEZE

CORPORATIONS, INC.
41 South Sixth Street • Newark 7, N. J.

Radio Ignition Shielding | Flexible Metal Tubing | Actuating Systems | Welded Diaphragm Bellows | Aero-Seal Hose Clamps

DOUGLAS DC-7

Airline Gains Continue as . . .

Air Transport Records Its Biggest Year

By Frank Shea, Jr.

The air transport boom continued to flourish in 1953, as the airline industry experienced the biggest year in its history. New peaks topped almost all previous records.

• **Revenues** of U. S. scheduled and non-scheduled airlines hit a record high of about $1¼ billion for a gain of about $140 million over 1952.

• **Total revenue ton-miles** climbed up around the 2¼-billion mark for an increase of approximately 260 million.

• **Domestic trunklines** accumulated more than 14 billion passenger-miles, a jump of nearly 18% over 1952.

• **U. S. international flag-carriers** experienced record traffic gains, as well as a big rise in net operating income. Total operating revenues increased by more than twice as much as total operating expenses.

Continued gains are forecast for 1954, both domestic and international but they are not expected to be quite as sharp.

Traffic in the last six months of 1953 did not maintain the very favorable rate of increase it enjoyed during the first half of the year, and this is taken as an indication of a slight leveling-off of the boom that has characterized the industry since 1950.

Heavy deliveries of new aircraft are causing a drop in load factor (payload as a percentage of capacity), and, at the same time, higher expense allowances to amortize the new equipment.

Higher overall operating costs, possible subsidy cuts and heavier competition from foreign-flag carriers are also big factors.

But the industry, on the whole, is optimistic. The trend is still upward, and most carriers are looking forward to another big year.

► **Prediction for '54: Even Better**—The 1954 forecast for all the world's airlines, excluding those of Communist countries, is a 10% payload increase over 1953. International Air Transport Assn. predicts that its 69 member airlines, who presently handle 85% of the world's commercial air traffic, will up their capacity by 10%.

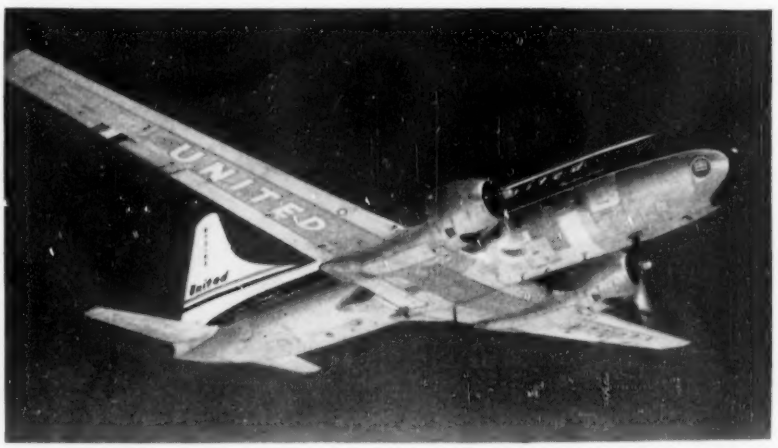
IATA estimates that carriers will spend about $200 million for over 300 transports scheduled for delivery during 1954 alone.

So the world-wide industry outlook is for another record-breaking year, with gains not as marked as last year but still substantial.

► **Cause for Optimism**—Optimism of U. S. carriers is based on the following trends:

• **Domestic trunklines** continue to make strong inroads in rail traffic. Trunkline passenger-miles were approximately one-half of first-class in 1948. Today, they are about 70% greater than Pullman-type traffic and about one-half of the total rail passenger traffic excluding commuting.

• **Coach service** is still on the upswing and continues to be a significant factor in airline expansion. This type of traffic has made tremendous gains, in many instances more rapidly than standard



CONVAIR 340

LOCKHEED 1049C

service. Big factor is that it has brought air travel within reach of the lower income brackets.

Airlines are now catering to these groups, consistently extending coach service to an increasing number of cities. The experiment began with three cities in 1948. This number jumped to 27 the following year, and by 1951 a total of 33 cities was served by aircoach.

In 1952, domestic coach traffic accounted for about 20% of combined coach-first class traffic, covering 47 cities. Last year, it climbed to 30% of the total as seven more cities were added. Even stronger gains are forecast for 1954.

• **Trunkline mail revenue** is expected to pick up substantially during the year. Big factor here is the growing Post Office experiment of shipping preferential first-class mail between major cities by air instead of rail where costs are competitive. This should offset the decline in military mail.

Post Office experiment presently encompasses service between New York/Newark and Chicago; between Washington, D. C. and Chicago; as well as New York, Chicago and Washington to major cities in Florida.

Rates on the New York/Newark-Chicago run are set at 18.66 cents per mail-ton mile, while Washington-Chicago is 20.04 cents. American, Capital, TWA and United are the carriers involved.

Delta C&S, Eastern and National Airlines are participating in the Florida segment. Delta and Eastern, from Chicago to Jacksonville, Tampa and Miami, receive 20.04 cents per mail-ton mile. National and Eastern receive 20.04 cents from Washington and 18.66 cents from New York/Newark.

Post Office also has enlarged the experiment to include local-service carriers, holding that their services could be used in emergency instances where movement of surface mail would otherwise be delayed.

In the light of initial success in these test cases, Air Transport Assn. is urging airlines to give full support to a nationwide expedited mail program in which all first-class mail would go by air when the distance to be covered is more than 400 mi.

ATA proposes a straight five-cent-per-ounce postage rate for all non-local first-class mail, including domestic airmail. Such a program would increase domestic airmail volume by an estimated 117 million ton-miles annually which, at prevailing rates, would pay the carriers approximately $55 million.

It is considered doubtful that such an extensive expedited system will be put into effect during 1954, but it could come soon. There is a definite trend toward more air transportation of surface mail, and as it gains momentum, results will show up in trunkline mail revenues.

• **Lift capacity** of domestic and international scheduled air services has gained 42% over the past three years, while operating aircraft have increased only 17%.

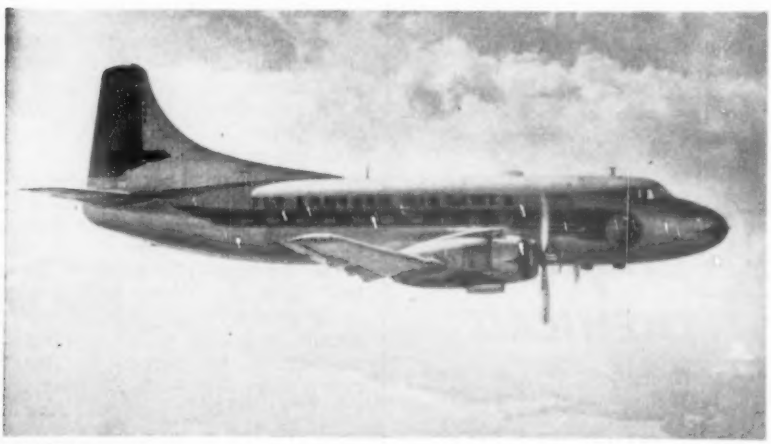
There were 1,336 aircraft in operation as of June 1953, compared with 1,142 in mid-1950. However, these planes, mostly larger and faster types, can carry a billion ton-miles a year more than the 1950 fleet.

A greater percentage of available ton-miles continues to be used. In 1950, domestic trunklines had 1,584 million ton-miles available, filling 849 million. But last year, with 2,629 million ton-miles available, revenue use climbed to 1,542 million.

• **Fleet additions** last year included five transport models that were not in service in 1950: Convair 340, carrying 40 passengers; Douglas DC-6B, seating more than 60; Lockheed 1049C Super Constellation, with capacity for more than 70; Martin 4-0-4, holding about 40; and the Douglas DC-7, with a maximum capacity of 95.

Deliveries of the Convair, Lockheed and the Douglas planes will continue throughout 1954.

Leader is the DC-7, latest addition



MARTIN 4-0-4

Specialists in Industrial Cleaning Products

Wyandotte ALUTONE at work: cleans, brightens, imparts a high luster to aluminum.

Another excellent example of how Wyandotte works for you!

Wyandotte research was given the job of developing a new aluminum brightener for exterior surfaces. The brightener had to meet two requirements: it had to both clean and brighten in one operation, and it could not have a tendency to develop "white deposits."

After extensive development and testing, Wyandotte produced ALUTONE, a product that filled *all* the requirements. How well ALUTONE meets the specifications is illustrated by this report from the Southern California Aircraft Corporation:

"ALUTONE saves us man-hours by eliminating degreasing. It cleans exteriors and brightens skin at the same time. By using ALUTONE, we get a high metallic luster, instead of a whitened or frosty surface after brightening."

CLEANING THE WORLD

This report is typical of those from ALUTONE users. It's also typical of use-reports on other specialized Wyandotte products — products developed to meet strict requirements . . . laboratory- and field-tested to assure top performance.

Call in your Wyandotte representative. He can help you with your metal cleaning and related operations; plating, spray-washing, burnishing, electrocleaning, paint-stripping, etc. He is backed by Wyandotte's research and facilities, and can recommend the specialized Wyandotte product designed to do your job better, faster and at a lower "use-cost." *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Angeles 12, California.*

Wyandotte CHEMICALS

Helpful service representatives in 138 cities in the United States and Canada

Largest manufacturer of specialized cleaning products for business and industry

to airline fleets. This Turbo Compound engine transport, with a maximum speed of 410 mph., may be the last piston engined airliner produced in the U. S. prior to the arrival of jets.

Cutting hours off flight schedules, the DC-7 alone should be a major factor in boosting passenger traffic in 1954.

• **Outstanding 1953 safety record** of the airline industry also should lure more passengers to air travel. Combined U. S. domestic and international scheduled carriers achieved a rate of 0.48 passenger fatalities per 100 million passenger-miles last year, compared with the 0.9 figure of 1952.

International operators lowered their 3.1 fatality rate of 1952 to 0.06. These carriers completed a full year of fatality-free operation last August for the eighth time in their history.

Nonsked Picture

Large irregular carriers had the only poor safety record, registering their third highest fatality rate since 1946—approximately 10.6 deaths per 100 million passenger-miles.

The fatality rate is but one of the nonscheduled airlines' big worries during 1954. Politically and economically, the outlook is none too bright. Main reasons:

• **Government crackdown** on nonsked violations of CAB regulations restricting non-certificated carriers from route-type operations.

• **Military contract reductions** due to budget cuts and Korean truce.

• **Increased competition** among themselves, as well as with scheduled airlines and railroads. Rails are cutting rates in bid for official troop movements, despite upward trend of other rail fares.

▶ **Chances for Survival**—A few nonskeds eventually may win certificates, and a few more might survive on strictly charter work, which CAB permits.

The others have two possible major means of survival:

• **Government easing** of certification requirements through changes in present attitudes of CAB, the Administration and Congress.

• **Favorable interpretation** by a federal court of the Civil Aeronautics Act and CAB powers under it.

• **More government contracts** from military, Post Office and other agencies.

Such developments are not forecast for the immediate future.

▶ **The Problem**—The nonsked "problem" arose after World War II when many persons bought or leased surplus aircraft, and CAB waived certification requirements for them to fly charter-type services. Result was that they were called "nonscheduled airlines."

To win the privilege of flying scheduled air service, an airline must prove

U.S. Scheduled Air Transport Industry—1953

Airline	Total Employes	Annual Payroll ($)	Unduplicated Route Miles	Scheduled Revenue Passenger Miles	Total Scheduled Passengers Flown	Total Cargo/Mail Ton-Miles	Total Revenues ($)	Equipment (Excluding Interchange)
DOMESTIC TRUNK (Including foreign operations)								
American Airlines	16,726	.....	10,831	3,289,972,000	5,817,000	83,143,000	208,305,856	NF: 77 CV-240, 25 DC-6B, 37 DC-6, 5 DC-7. AC: 13 DC-6. C: 7 DC-4. Charter: 1 DC-4.
Braniff Airways	4,004	18,000,000*	15,578	553,384,000	1,313,798	2,661,371	40,000,000*	23 DC-3, 9 DC-6, 23 CV-340, 7 DC-4, 1 C-47.
Capital Airlines	4,446	24,000,000	5,160	716,000,000	2,248,998	9,424,784	45,580,524	24 DC-3, 24 DC-4, 1 C-47, 1 C-54, 12 Connie.
Colonial Airlines	773*	3,901,081	3,013	131,520,056	418,756	665,488	9,090,168*	NF, C, AC: 8 DC-3, 5 DC-4.
Continental Air Lines	921	4,433,824	3,195	147,508,685	368,490	541,984	9,277,080*	NF: 10 DC-3, 7 CV-340, 2 DC-6B.
Delta—C & S Air Lines	4,285	19,893,662	10,035	26,560,770	1,461,625	11,260,704	42,338,850	7 DC-6, 5 DC-4, 32 DC-3, 19 CV-340, 6 Connies.
Eastern Air Lines	10,246	50,000,000*	11,829	2,500,000,000*	4,750,000*	19,000,000*	.....	NF: 60 4-0-4, 8 L-1049C. NF & AC: 13 L-1049, 19 L-749, 10 DC-4. C: 1 DC-4.
National Airlines	2,915	12,900,000	2,829	618,005,000	889,273	9,334,175	35,232,967	3 DC-7, 8 DC-6B, 4 DC-6, 8 CV-340, 11 L-18, 1 S-55.
Northeast Airlines	864	4,027,011	2,273	91,398,933	463,712	1,036,609	8,497,440*	NF: 4 CV-240, 12 DC-3.
Northwest Airlines	5,420	28,600,000*	17,255	851,174,754	1,098,693	18,229,181	61,996,213*	10 B-377, 21 DC-4, 8 DC-3 and 3 DC-6B.
Trans World Airlines	15,000	.....	33,000	2,881,066,000	3,100,000	54,244,000	.....	10 L-1049, 68 Connie, 52 4-0-4, 13 DC-4.
United Air Lines	14,921	77,525,000	10,809	2,717,407,639	3,950,740	59,582,764	172,967,280	21 DC-6B, 43 DC-6, 6 B-377, 42 CV-340, 23 DC-4, 35 DC-3.
Western Air Lines	1,813	8,743,753	5,429	359,115,000	837,384	3,890,409	22,879,000*	NF: 9 DC-3, 4 DC-6B, 10 CV-240. AC: 5 DC-4.
TERRITORIAL INTERNATIONAL								
Caribbean Atlantic Airlines	175	526,000*	388	9,744,378	120,491	31,027	1,199,280	3 DC-3.
Hawaiian Airlines	515	2,541,298	404	52,058,919	394,970	1,492,822	4,901,889	5 CV-340, 7 DC-3. C: 3 DC-3.
Pan American-Grace Airways	1,338	.....	8,784	136,038,000	124,819	3,583,722	.....	NF: 6 DC-6. NF or AC: 9 DC-3. AC: 2 DC-6B, 3 DC-4. C: 1 DC-3.
Pan American World Airways	17,254	84,200,000	62,050	2,015,103,000	1,657,275	74,441,448	.....	28 B-377, 31 DC-6B, 8 L-49, 27 DC-4, 13 Convair 8 DC-3.
Trans-Pacific Airlines	207	868,414	1,007	19,789,167	158,107	107,729	1,824,460	5 DC-3.
LOCAL SERVICE								
Allegheny Airlines	486	2,102,705	2,221	31,234,848	212,049	3,214,999	4,079,750	13 DC-3.
Bonanza Air Lines	201	933,000	1,449	15,245,000	65,651	85,362	1,820,000*	5 DC-3.
Central Airlines	304	1,000,000	1,428	6,397,000	42,496	683,772	2,075,000*	NF: 6 DC-3.
Frontier Airlines	550	2,570,000	3,086	32,389,000	127,765	605,088	4,900,000	NF: 12 DC-3.
Lake Central Airlines	297	1,219,000	1,445	8,347,000	56,311	107,120	1,903,420*	NF: 7 DC-3. Military contract: 1 C-46 leased.
Mohawk Airlines	328	1,428,070	1,149	27,116,000	162,078	172,916	2,861,262*	10 DC-3.
New York Airways	90	375,989	.....	5,786	1,513	41,631	.....	5 S-55.
North Central Airlines	620	2,525,646	2,659	37,625,511	217,663	274,468*	.....	NF: 19 DC-3.
Ozark Air Lines	384	1,750,000	2,708	20,343,000	124,445	104,220	3,327,557	NF: 13 DC-3.
Piedmont Aviation	743	3,015,000	2,733	56,769,172	269,773	434,180	5,744,618*	15 DC-3.
Pioneer Air Lines	396	1,842,542	1,972	40,750,223	146,859	320,906	3,646,540*	NF: 9 DC-3.
Southern Airways	412	1,707,549	1,912	19,286,489	112,328	167,819	3,241,834*	NF: 10 DC-3.
Southwest Airways	323	1,796,907	1,214	2,633,923	178,817	244,495	3,309,568	NF: 9 DC-3 4 2-0-2.
Trans-Texas Airways	529	1,864,892	3,420	20,934,000	97,304	244,347	3,421,735	16 DC-3.
West Coast Airlines	370	1,800,000	2,025	3,509,253	161,614	114,308	3,319,434	12 DC-3.
MAIL & CARGO								
Flying Tiger Line[1]	1,952	9,474,517	.....	NA	NA	51,268,229[2]	27,840,234	27 C-46 7 C-54 4 DC-6A.
Helicopter Air Service	45	209,000*	314	NA	NA	2,848,500*[3]	526,000*	6 47-D 1 47-D1.
Riddle Airlines	177	907,334	2,280	2,456,832	15,268,565	13,593,643[1]	2,835,384	C: 9 C-46.

* — Approximate. In some cases these are preliminary unaudited figures.

NA — Not applicable.

[1] Flying Tiger Line and Slick Airways merger was approved by Civil Aeronautics Board on January 7, 1954. Corporate name: Flying Tiger Line.
[2] Cargo ton-miles.
[3] Mail ton-miles.

Equipment Code:
AC: Aircoach.
C: Cargo.
NF: Normal fare.

Source: Airline reports to AVIATION WEEK.

public convenience and necessity for its proposed route services.

Many nonskeds expanded their services with demand and became, in effect, scheduled airlines without certificates. Then they began pushing for certification.

CAB decided in the transcontinental coach case that there was no need for new certificated aircoach services. But the nonskeds have continued fighting for rehearing through the courts, Congress, the Administration and CAB.

Some have violated Board restrictions, but CAB has been hard put to stop this through enforcement proceedings, largely because of the delays of due process of law in the courts.

The wheels of due process grind slow, but the Board's machine of enforcement action against nonskeds is speeding up.

have you heard this one

about TURBINE WHEEL BROACHING ?

Here's an instance where LAPOINTE engineering resulted in the saving of time and money, tools and machines, because of an *interchangeable fixture.*

TWO TURBINE WHEELS with different diameters, with 8-branch and 4-branch "pine tree" slots, were BROACHED WITH THE SAME BROACH!

50 YEARS IN BROACHING! We're the oldest in the world!

1902 • GOLDEN ANNIVERSARY • 1952

Bulletin AW-26 describes Lapointe Broaching Machines, Tools and Fixtures that will help to eliminate production bottlenecks in your plant.

LAPOINTE

MACHINE TOOL COMPANY

HUDSON · MASS · U. S. A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

■ AIR TRANSPORT

Repeated court precedents are narrowing the issues.

1954 should see the nonsked problem partially, if not wholly resolved.

Helicopters

Last year furnished ample evidence that short-haul commercial use of the helicopter is here to stay. Chief developments:

• **Inauguration** of first scheduled passenger service in U.S. by New York Airways, flying Sikorsky S-55s between New York City's three major air terminals—La Guardia, Newark and Idlewild.

• **Continued growth** of Los Angeles Airways and Helicopter Air Service, Inc., of Chicago, both carrying mail and cargo.

• **Unveiling** of the giant Piasecki YH-16, with capacity for 35-40 passengers.

• **Sabena Belgian airlines'** introduction of the first international helicopter passenger service between Brussels and Lille, France, and between Brussels-Antwerp and Rotterdam in Holland. Sabena has a fleet of S-55s.

Early 1954 developments make an even stronger case for the helicopter:

• **National Airlines'** inauguration of service to resort areas within a 15-mi. radius of Miami, using S-55s.

• **Successful flight** of the new 26-passenger, 150-mph. Sikorsky S-56, reported to equal DC-3 performance, besides having inherent advantages of the helicopter.

During the coming year, New York Airways expects to begin regular service to downtown New York City. The only thing that is delaying this program is the location of suitable heliports. The carrier also hopes to develop commuter service extending over its present suburban mail routes.

Both Los Angeles Airways and Helicopter Air Service, Inc., hope to begin scheduled passenger operations before the year is out.

All carriers eventually plan to replace their present fleets with higher-speed, larger-capacity aircraft. But National has jumped the gun and secured an option on the first commercial version of the S-56.

Indications are that the helicopter will be the answer to the airline industry's short-haul traffic problems. ATA forecasts that intercity helicopter passengers will reach 6 million a year by 1960, with copters flying a third of the intercity traffic by 1970.

International

Having led the scheduled U. S. airline industry to record total operating profits last year, U. S. flag carriers have cause to look forward to another big year.

Flag lines owe most of their 1953 profit to final agreement with CAB on "fixed" mail subsidy rates, including profit. Most mail and subsidy pay reported for years before 1953 were on a "temporary" break-even basis.

Increased tourist service should account for a substantial traffic jump in 1954. Despite slight fare increases

WORLD AIR TRAFFIC GAINS 1937-53

(Scheduled Services)

	Miles Flown	Passengers Carried	Passenger-Miles	Cargo Ton-Miles	Mail Ton-Miles	Average number of passengers per aircraft	Average distance flown per passenger
	millions					(number)	(miles)
1953	1 170	52,0	28 580	700	185	24,5	550
1952	1 059	45,0	24 540	651	175	23,2	547
1951	976	39,9	21 380	612	160	21,9	536
1950	890	31,2	16 960	518	143	19,1	544
1949	838	26,5	14 480	390	128	17,3	546
1948	789	23,5	12 990	286	114	16,5	552
1947	708	21,0	11 740	187	88	16,6	559
1937	165	2,6	880	n.a.	n.a.	5,3	350
	INCREASE OR DECREASE BETWEEN YEARS						
1952-53	+ 10%	+ 16%	+ 18%	+ 7%	+ 5%	+ 6%	+ 1%
1951-52	+ 9%	+ 13%	+ 15%	+ 6%	+ 9%	+ 6%	+ 2%
1950-51	+ 10%	+ 28%	+ 26%	+ 18%	+ 12%	+ 15%	- 1%
1949-50	+ 6%	+ 18%	+ 17%	+ 33%	+ 12%	+ 10%	- 1%
1948-49	+ 6%	+ 13%	+ 11%	+ 36%	+ 13%	+ 5%	- 1%
1947-48	+ 11%	+ 12%	+ 11%	+ 53%	+ 30%	- 1%	- 1%
1947-53	+ 65%	+ 140%	+ 143%	+ 274%	+ 111%	+ 48%	- 2%
1937-53	+ 607%	+ 1 980%	+ 3 162%	n.a.	n.a.	+ 362%	+ 57%

Note: *Excludes USSR and China* N.A. — *Not Available*

Source: *International Civil Aviation Organization*

Airline Subsidy Trends

	1951	1954	1955
DOMESTIC			
Group 1:			
American	$1.0	0	0
Eastern	0.5	0	0
TWA	0.9	0	0
United	1.3	0	0
Group 2:			
Braniff-MCA	2.3	0.5	0.5
Capital	1.6	0	0
Delta-C&S	1.5	0	0
National	1.3	0	0
Northwest	4.2	0	0
Western	0.9	0	0
Group 3:			
Colonial	1.1	0.8	0.8
Continental	1.2	0.7	0.7
Northeast	1.1	1.6	1.6
Piedmont	1.2	1.6	1.5
Pioneer	1.1	1.0	1.0
Group 4:			
Frontier	2.4	2.9	2.9
Mohawk	0.9	1.0	1.0
Southwest	0.8	1.1	1.1
Group 5:			
Allegheny	1.8	1.8	1.8
Bonanza	0.6	0.9	0.9
North Central	1.2	2.5	2.5
Ozark	0.8	2.0	2.0
Southern	1.4	1.8	1.8
Trans-Texas	1.6	2.6	2.6
West Coast-Empire	1.2	1.6	1.6
Group 6:			
Central	0.9	1.7	1.7
Lake Central	0.6	1.5	1.5
HELICOPTERS			
HAS (Chicago)	N.A.	0.4	0.4
Los Angeles	N.A.	0.8	0.8
New York	N.A.	1.1	1.4
INTERNATIONAL & OVERSEAS			
Trans-Atlantic			
Pan American	10.6	8.2	8.0
TWA	4.2	4.5	4.4
Latin America			
Pan American	4.9	11.2	11.2
Braniff	2.0	3.0	2.9
Delta	1.6	0.7	0.7
Panagra	1.2	2.2	2.2
Caribbean-Atlantic	0.2	0.1	0.1
Trans-Pacific:			
Northwest	3.0	4.0	3.9
Pan American	7.8	7.9	7.8
Intra-Hawaiian:			
Hawaiian	...	0.6	0.6
TPA	...	0.5	0.5
U. S.-Alaska			
Alaska	...	1.2	1.2
Pacific-Northern	...	0.8	0.8
Pan American	0.8	1.3	1.3
Intra-Alaska:			
Nine lines	2.5	4.7	4.7
Five lines	0.4	...	...

Source: CAB revised report, September, 1953.

scheduled for North Atlantic routes, the general tendency of U. S. carriers is toward lower tariffs.

Indications are that the U. S. operators attempted to fight the North Atlantic increase when it was proposed at the IATA meeting in Honolulu last October, but rather than buck IATA they went along in hopes of getting compromise reductions in other areas.

► **Fare Incentive**—General feeling is

Here's how to

reduce size & weight

(WITHOUT DECREASING OUTPUT)

–install MYCALEX® glass-bonded mica Slot Wedges and Brush Holders

- WITHSTAND CONTINUOUS OPERATING TEMPERATURES TO 650°F
- EXPANSION MATCHES MATING METALS—NO LOOSENING FROM COLD START TO MAX. OPERATING TEMPERATURE
- IMPERVIOUS TO OIL AND MOISTURE, NO COLD FLOW, NO SHRINKING, NO CHANGE WITH AGE
- EXTREME ARC RESISTANCE, CAN NOT CARBONIZE, WILL NOT BURN, HIGH DIELECTRIC STRENGTH

MYCALEX 410 glass-bonded mica withstands continuous operating temperatures of 650°F. This temperature endurance makes it possible to install MYCALEX in critical insulating areas—slot wedges and brush tubes—thereby increasing permissible temperature rise of motors and generators. Thus power ratings may be safely increased without change in size or weight. Conversely, a unit of specified size can be redesigned to smaller dimensions. Significant gains have been made in this direction, particularly in aircraft systems. Dimensional accuracy of these parts injection-molded of MYCALEX 410 glass-bonded mica, the unique ceramoplastic insulation, exceeds that of any ceramic or plastic material . . . their smooth surface speeds assembly, reduces costs. For complete information call or write J. H. DuBois, Vice President-Engineering, at Clifton, N. J. address below.

NOTE: MYCALEX 410 glass-bonded mica, described above, is an exclusive formulation of, and manufactured only by, the Mycalex Corporation of America. It meets all the requirements for Grade L-48 under Joint Army-Navy Specifications JAN-I-10.

SINCE 1919 MYCALEX® THE INSULATOR

MYCALEX CORPORATION OF AMERICA

World's largest manufacturer of glass-bonded mica products

Executive Offices: 30 Rockefeller Plaza, New York 20, N. Y.

ADDRESS INQUIRIES TO—

General Offices and Plant: 117 Clifton Blvd., Clifton, N. J.

that the easiest way in which new traffic can be gained is through reduction in the general level of fares. Any such reduction, however, is dependent for its continuation on a considerable increase in the volume of traffic in order to maintain substantial airline revenues.

A look at the record over the postwar years gives ample evidence of the increasing tendency toward lower international fares.

In 1945, a oneway trans-Atlantic crossing cost about $600. Last year, it was down to two-thirds of that level for first-class travel ($395). As a result of Pan American World Airways' crusade for low-rate international tourist service, tourist fares went down more than 50%.

This year, 25% cuts are scheduled for trans-Pacific fares. Pan American also is effecting a $400 slash on its round-the-world service, offering tourist flights for $1,300 as opposed to $1,700 for first-class.

▶ **1954 Outlook**—Several factors will have tremendous influence on U. S. flag-carrier operations in 1954.

• **Supreme Court offset decision**, if the full interpretation is applied, could result in a major reshuffling of flag-carrier routes, with TWA, Northwest, Braniff and Delta-C&S possibly having to drop international operations.

In its ruling, Supreme Court held that excess profits accruing from domestic operations must be offset against international subsidy requirements. Since TWA, Northwest, Braniff and Delta all have combined domestic-international operations, the decision could be crippling.

Pan American is the only airline that would stand to benefit, since it has no domestic service whatsoever.

• **Heavy subsidy slashes** would also have drastic effects. House Appropriations Subcommittee has cut $28 million off CAB's request for $50 million subsidy. General industry feeling is that such an extensive cut won't stick, but reduction of some sort seems certain.

• **Decisions on route cases**, several long-pending, could have far-reaching effects on international routes. This year possibly will see rulings on such controversial cases as New York-Balboa Through-Service Proceeding, the Trans-Atlantic Cargo Case, Resort Airlines Miami Stopover Investigation and the States-Alaska Case.

• **Seasonal problem** must be resolved, especially on North Atlantic routes. Consistent traffic gains will depend largely on stimulation of more winter traffic.

Comparative transport costs
Direct operating cost per U. S. domestic plane-mile

9 mos. ending Sept. 30, 1953

	Flying operations (Cents)	Direct Maintenance (Cents)	Depreciation Charges (Cents)	Total Direct Oper. Cost (Cents)
Douglas DC-3	31.97	11.10	2.62	45.69
Douglas DC-4	46.82	18.88	4.25	69.95
Convair 240	41.23	24.97	11.69	77.89
Convair 340	44.26	14.99	20.13	79.38
Martin 4-0-4	43.16	19.35	26.84	89.35
Douglas DC-6	52.15	21.03	16.17	89.35
Douglas DC-6B	55.69	18.10	23.48	97.27
Lockheed 749	61.36	27.16	15.19	103.71
Lockheed 1049	74.09	31.30	41.42	146.81
Boeing 377	84.56	49.09	36.62	170.27

Source: Air Transport Assn. compilation of uniform Form 41 reports by domestic trunklines to Civil Aeronautics Board.

Jet Transports

The era of the jet transport continues to loom on the horizon for both domestic and flag airlines. Leading contenders are Britain's de Havilland Comet 3 and Boeing's Model 707.

▶ **Certification for Comet**—Pan American has three Comet 3s presently on order, with seven more on option. But CAA certification is the big obstacle to be overcome before the Comet can see service on U. S. routes.

As yet, CAA does not have sufficient information to estimate the possibilities for certification. First model is expected to fly this summer, to beat the 707's first flight.

CAA will be especially cautious about certificating Comet 3s in view of the six crashes of Comet 1s over the past 15 months. Certification is considered doubtful in 1954.

▶ **Boeing 707**—Boeing's 707 is expected to hold a considerable edge in speed and power over the Comets. Data available indicates that the 707 will cruise in the near-600-mph. class, presumably around 580 mph. But the airliner may achieve block-to-block speeds in normal transport operations as high as 550 mph. for some distances.

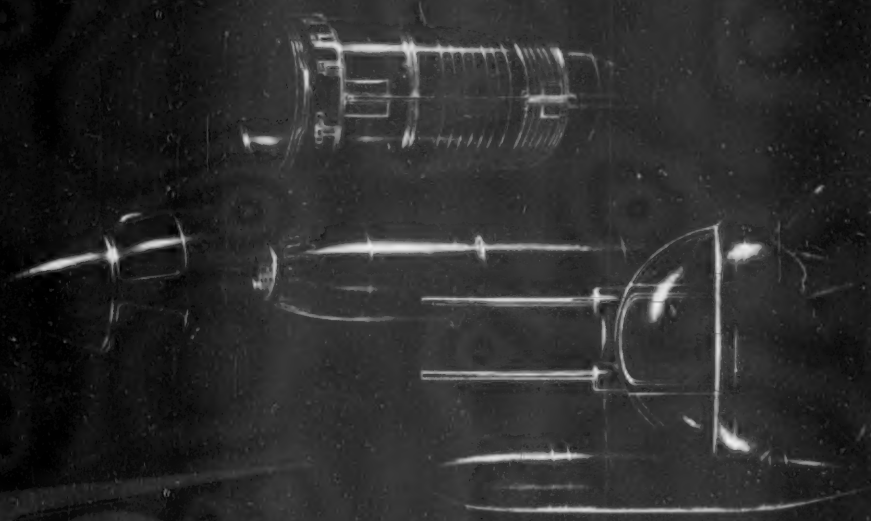
This would give Boeing a considerable advantage over de Havilland, now quoting 470-mph. speed for the Comet 1, 500 mph. for the Comet 2 and

U.S. Scheduled Domestic Air Coach 1953

Airline	Passengers Carried			Passenger Miles			Load Factor (%)			Revenue		
	1951	1952	1953	1951	1952	1953	1951	1952	1953	1951	1952	1953
American Airlines	101,836	233,674	371,000	178,078	377,311,205	564,119,000	86.30	88.1	75.3	$7,820,000	.....	.....
Bonanza Air Lines	.....	1,768	2,726	.....	451,000	698,000	.....	40.0	52.36	.....	$22,550	$34,900
Braniff Airways	.....	.....	2,732[1]	.....	.....	1,561	.....	.....	60.27	.....	.....	.....
Capital Airlines	217,962	237,385	266,047	109,646	116,479,539	131,742,000	62.92	59.89	56.67	4,906,127	6,115,566	.....
Colonial Airlines	.....	8,135	39,607	.....	2,352,233	11,555,355	.....	56.85	61.01	.....	102,889	510,634
Delta-C&S Air Lines	.....	80,326	139,440	47,560	70,047,000	108,986,000	.....	71.88	68.31	.....	933,525	4,514,036
Eastern Air Lines	322,781	560,215	674,735*	292,023	529,791,000	655,250,000*	74.43	74.03	.....	11,923,528	21,699,533	.....
National Air Lines	102,253	197,134	309,544	95,059	179,956,000	303,091,000	64.31	71.24	76.32	4,416,726	7,872,633	12,273,676
Northwest Airlines	99,277	222,815	310,419	111,354	211,216,000	291,759,371	78.80	68.75	65.53	5,380,000	12,460,091	13,939,702
Trans World Airlines	185,000	379,455	730,000	251,000	578,965,000	1,027,704,000	76.80	86	.....	11,380,000	.....	.....
United Air Lines	219,706	332,818	563,430	104,800	270,294,025	522,491,600	73.98	76.4	73.2	4,462,783	11,197,320	22,214,783
Western Air Lines	207,008	269,700	251,748	81,685	112,504,000	109,241,000	75.38	71.01	65.55	3,061,000	4,500,000	4,645,000*

*—Approximate. [1] One month only.
Source: Airline reports to AVIATION WEEK.

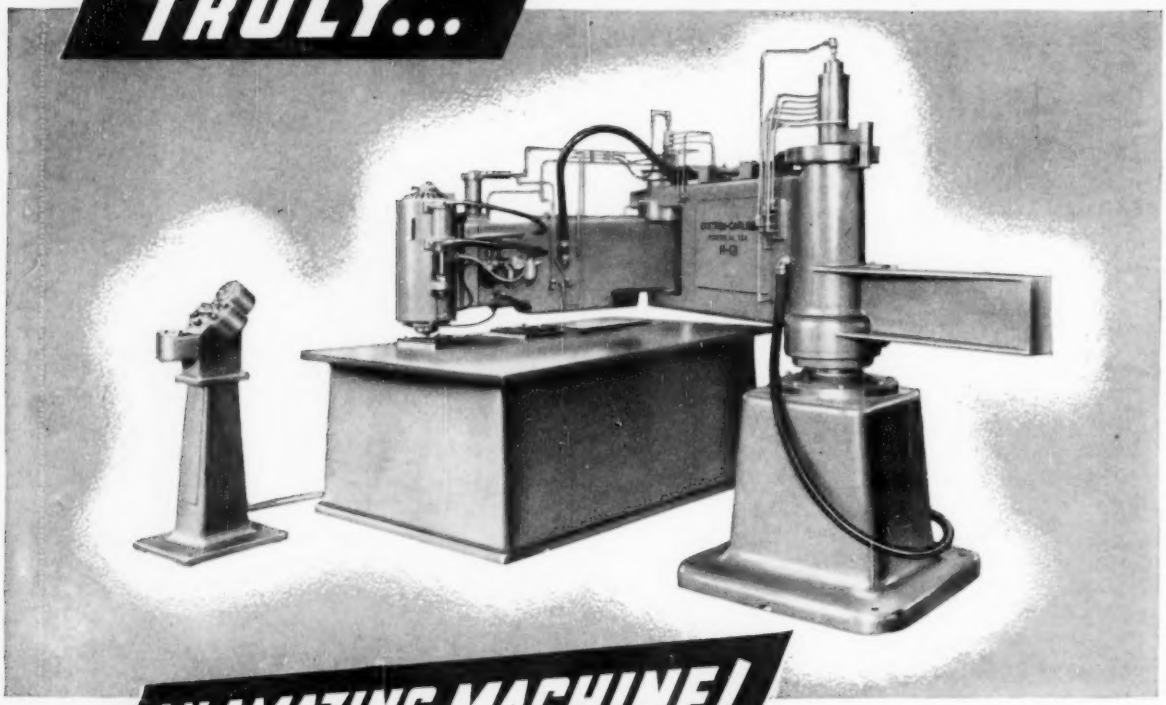
Rheem serves as a prime contractor to the United States Government . . . and as a sub-contractor to Lockheed, Northrop, Douglas, and Westinghouse — leaders in the world of aviation.



RHEEM Manufacturing Company . . . Aircraft Division, Downey, California

RESEARCH • DEVELOPMENT • ENGINEERING • PRODUCTION

TRULY...



AN AMAZING MACHINE!

EKSTROM, CARLSON

H-121 "POWER-ARM"

CONTOUR ROUTING *and* MILLING MACHINE

Powerful!
Fast-cutting!
Easy to Operate!

Do you want to banish, forever, tedious, *back-breaking* manual routing in the machining of your aircraft parts? Then, *here's* EKSTROM, CARLSON's solution! This machine, conceived by us, is specially designed to provide greater production at lower cost when template-routing and milling today's heavy aluminum plate or thick stacks of tough-cutting aluminum sheets. Hydraulically-operated, the entire operation is effected from a "Utopian" remote control pushbutton stand that starts the motors, lowers the head for template contact prior to the actual cutter descent, and controls the speed, rapid traverse, and direction of travel. The spiral-flute, collet-mounted router bit (also an ECCo product) is direct-driven by a high-cycle, 30 hp motor at 14,400 rpm. Even an inexperienced operator can quickly learn how to "pilot" the head around the most intricate template, and can then proceed to turn out an amazing quantity of work. For further details on this entirely new and revolutionary machine, write us *TODAY* . . . and learn all about it!

ECCO

DEPT. A-4
EKSTROM, CARLSON & CO.
1400 Railroad Ave.
Rockford, Ill.

FOR GREATER AIRCRAFT PRODUCTION!

slightly more than 500 mph. for the Comet 3.

Designed for nonstop transcontinental and for trans-Atlantic service, the 707 is larger, heavier and carries more payload than the earlier Boeing Model 473 jet transport design or the current piston-engine Stratocruiser.

According to CAA, U. S. turbine-powered transports should be flying the nation's airlanes within the next three to five years.

In a study by its turbine-powered transport evaluation team, CAA predicts that turbojet and turboprop transports will be flying domestically before they are used in international service.

Two principal developments are speeding introduction of jet airliners in the U. S.:

• **Accent on speed** brought about by DC-7s and Super Constellations.

• **Impact of British** turbine-powered transports.

Long-Range Outlook

Barring a sharp decline in the economy, U. S. airlines should be able to look forward to continued growth for the next several years at least.

U. S. is currently undergoing tremendous increase in living standards, where the ordinary citizen buys out-of-the ordinary things. According to the National Planning Assn., this is a trend that means "the luxuries of yesterday become the necessities of today."

Travel is luxury to most people, especially air travel. But so are many other items on the American economy.

► **Wooing the Dollar**—As the standard of living increases, airlines will not only find themselves competing with other modes of transportation, but with a variety of "luxury" consumer goods and services.

Competition from other forms of consumer spending will be keen. The share of the consumer dollar that goes for travel by air will depend, in the final analysis, on how attractive air travel can be made for the growing mass market.

Other factors that should contribute to air transport growth:

• **Growing population** of the U. S. is shifting across the country to the West and Southwest. Long-range implications of this movement for air travel are tremendous. A big population on the West Coast means more cross-country travel—longhaul travel ideally suited to the airlines.

• **Large cities** and suburbs are attracting a large percentage of the population. This concentration is a big booster for airlines, since most air travel originates in large cities. More intercity travel is inevitable.

• **Commuter traffic** is a great potential for the helicopter. The copter has two big advantages over railroads for carrying commuter traffic. It does not require as much expensive urban real estate, and it can be shifted easily from commuter service to short intercity service for operation during slack commuting periods.

• **Business abroad** will represent a gradually increasing share of U. S. business and will require an increase in travel.

By 1960, the radius of business travel should extend into northern Canada, South America, West Africa and Western Europe—not just occasionally, but frequently. This entire area will be more closely knit together by highspeed transportation. Airlines offer the most expeditious service.

• **General decentralization** of industry offers still another potential air travel market.

From all indications, the long-range outlook for the air transport industry is a bright one. The potential is there. It remains for the airlines to exploit it.

U. S. Aircraft Engaged in Air Transportation

(AS OF DECEMBER 31, 1953)

Type of Operation	Service	DC-7	DC-6	DC-4	DC-3	1049	749	649	049	18	12	5-C	4-O-4	2-O-2	377	340	240	C-46	S-51	S-55	47D	CH-300	RB-1	G-44	G-21A	PBY	RC-3	S-43	Total
(1) Sched. Dom.	Aircraft Utilized for Trunk and Feeder Serv. Only	0	62	71	290	10	18	0	37	11	0	0	100	25	0	98	13	0	0	0	0	0	0	0	0	0	0	0	735
(2) Sched. Dom.	Aircraft Utilized for Helicopter Service Only	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	8	6	0	0	0	0	0	0	0	17
(3) Sched. Dom.	Aircraft Utilized for "Cargo Only" Service	0	2	11	0	0	0	0	0	0	0	0	0	0	0	0	0	57	0	0	0	0	0	0	0	0	0	0	70
(4) Sched. Dom.	Aircraft Utilized for Intrastate Service (lg. Acft.)	0	0	0	10	0	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
(5) Sched. Int.	Aircraft Utilized for International Service Only	0	42	55	58	0	0	0	9	0	0	1	0	0	27	5	14	17	0	0	0	1	0	2	12	2	1	1	247
(6) Sched. Dom. & Int.	Aircraft Utilized for either Domestic or International Service	10	113	55	26	21	44	5	0	0	0	0	0	0	16	18	77	0	0	0	0	0	0	0	0	0	0	0	385
(7) Irreg. Dom. & Int.	Aircraft Utilized in Irregular Air Carrier Service	0	0	52	36	0	2	0	0	1	0	0	0	0	0	0	0	70	0	1	0	0	0	0	0	3	0	1	164
(8) Grand Total	Air Carrier Acft. in Domestic and Int. Service	10	219	244	420	31	62	5	46	12	1	1	100	29	43	121	104	144	3	9	6	1	0	2	12	5	1	2	1,633

NOTE: To find total of scheduled air carrier aircraft in Domestic Services, add 1, 2, 3, 4 and 6.
To find total of scheduled air carrier aircraft in International Services, add 5 and 6.

Aircraft identification by manufacturer:
Bell: 47D
Bellanca: CH-300.
Boeing: 377 Stratocruiser.
Budd: RB-1 Conestoga.
Convair: 340 Convair-Liner; 240 Convair-Liner; PBY Catalina.
Curtiss: C-46 Commando.
Douglas: DC-7; DC-6; DC-4; DC-3.
Grumman: G-44 Widgeon; G-21A Goose.
Lockheed: 1049 Super Constellation; 749 Constellation, 649 Constellation; 049 Constellation; 18 Lodestar;. 12; 5-C Vega.
Martin: 4-O-4; 2-O-2.
Republic: RC-3 Seabee.
Sikorsky: S-55; S-51.

Source: CAA.

Vard
Specialists
IN ROTARY-LINEAR ACTUATION FOR INDUSTRY

The VARD ball screw is an efficient, accurate and reliable mechanism. When combined with electric, hydraulic or pneumatic power units these ball screws provide the most efficient known means for transmitting rotary to linear motion.

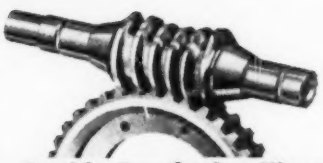
Engineering inquiries for information concerning specific applications should be directed to the VARD sales department.

VARD INC
PASADENA 8, CALIFORNIA

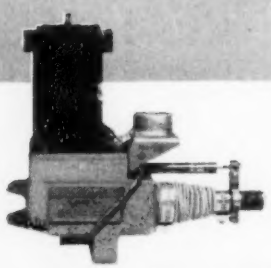
CUSTOM DESIGNERS AND MANUFACTURERS OF:

BALL SCREWS

MECHANICAL DRIVES



Double Enveloping Worms



Electro-Mechanical Actuators

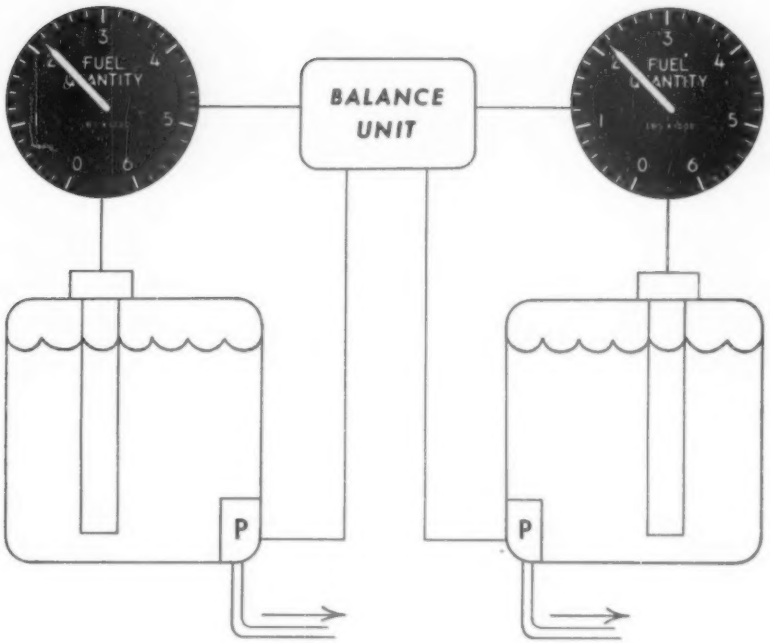
HYDRAULIC SYSTEMS

FRACTIONAL H. P. MOTORS

AIRCOACH GROWTH

Carriers Providing Service as of December

CITIES SERVED	1948	1949	1950	1951	1952	1953
Chicago	1	6	6	6	7	8
New York	1	6	6	7	8	8
Pittsburgh	1	2	2	2	3	3
Albuquerque	—	1	1	1	1	1
Amarillo	—	1	1	1	1	1
Atlanta	—	1	2	2	2	2
Billings	—	1	1	1	1	1
Birmingham	—	2	2	2	2	3
Cleveland	—	1	2	2	3	4
Detroit	—	2	3	3	3	5
Jacksonville	—	1	3	3	3	3
Kansas City	—	1	1	1	1	2
Knoxville	—	1	1	1	1	1
Los Angeles	—	3	4	4	4	4
Miami	—	3	3	3	3	3
Milwaukee	—	2	2	2	2	2
Minneapolis	—	2	2	2	2	3
Mobile	—	2	2	2	2	2
New Orleans	—	3	2	2	2	2
Phoenix	—	1	1	1	2	1
Portland, Ore.	—	2	3	3	3	3
San Francisco	—	1	2	3	3	3
Seattle	—	2	3	3	3	3
Spokane	—	1	1	1	1	1
Tampa	—	1	1	2	2	2
Washington	—	3	3	3	6	6
Wichita	—	1	1	1	1	2
Charlotte	—	—	1	1	1	1
Cincinnati	—	—	1	1	1	1
Great Falls	—	—	1	1	1	1
Houston	—	—	1	1	1	2
West Palm Beach	—	—	1	—	—	—
Dallas	—	—	—	1	1	3
St. Louis	—	—	—	1	1	2
Burlington, Vt.	—	—	—	—	1	1
Denver	—	—	—	—	1	1
Las Vegas	—	—	—	—	1	1
Long Beach	—	—	—	—	1	1
Madison	—	—	—	—	1	1
Norfolk	—	—	—	—	1	1
Omaha	—	—	—	—	1	1
Philadelphia	—	—	—	—	1	3
Rochester, Minn.	—	—	—	—	1	1
Salt Lake City	—	—	—	—	1	2
San Antonio	—	—	—	—	1	2
San Diego	—	—	—	—	1	2
Scranton	—	—	—	—	1	—
Syracuse	—	—	—	—	1	—
Boston	—	—	—	—	—	4
Buffalo	—	—	—	—	—	1
Chattanooga	—	—	—	—	—	1
Hartford	—	—	—	—	—	1
Indianapolis	—	—	—	—	—	1
Jackson, Miss.	—	—	—	—	—	1
Memphis	—	—	—	—	—	1
Oklahoma City	—	—	—	—	—	1
Shreveport	—	—	—	—	—	1
Total Cities Provided Coach Service	3	27	32	33	47	54



How does AVIEN maintain this "BALANCE OF POWER"?

A current tanker aircraft specification calls for large fuel tanks fore and aft. Obviously the pilot must know the fuel quantities in both systems. What is more, this stored power must be distributed "in balance" equally between the two.

Control of the plane's center of gravity and constant, accurate indication of fuel quantities are both handled automatically by an Avien voltage-fed balancing system and the well-known Avien Fuel Gages.

Fuel weight distribution data are supplied by one additional potentiometer in each fuel gage indicator.

A typical Avien safety feature is *incorporated in the balancing amplifier.* It detects and warns of a pump or valve failure in either system.

The entire installation has been achieved by Avien with a minimum of weight, complexity and cost. This is another example of the essential adaptability of the Avien fuel-gaging system which can be "tailored" to the exact specifications of many different aircraft.

Every month, Avien produces over ten thousand major instrument components for the aviation industry. They have been specified for more than fifty different aircraft models.

If you have a fuel gage or fuel management problem, call on us.

ENGINEERING IN DEPTH—Avien

58-15 NORTHERN BLVD., WOODSIDE 77, N.Y.
AIRCRAFT AND INDUSTRIAL INSTRUMENTATION

FAIRCHILD C-119

MATS Operation Set for Peace or War

World's largest air transport operation holds record of flying 500,000 persons over 115,000 miles to 38 countries without a fatality.

Military Air Transport Service, world's largest air transport operation, during 1953 carried 500,000 passengers without a fatality across 115,000 mi. of international air routes to 38 countries.

MATS is made up of three divisions:

• **Pacific Division.** Commanded by Rear Adm. William D. Johnson at Hickam AFB, Hawaii, this unit is responsible for air supply of U.S. Far East Forces in Japan and Korea, and military missions to individual countries as far as Dhahran, Saudi Arabia. Aircraft assigned to this division made 9,800 trans-Pacific flights in 1953, hauling 227,000 passengers and patients and 34,750 tons of cargo and mail. This is less than the 1952 record because of the Korean airlift cutback.

• **Atlantic Division.** Based at Westover AFB, Mass., and commanded by Brig. Gen. John M. Hopkins, this division directs transport operations across the Atlantic to Europe and Africa, linking with the Pacific Division at Dhahran. Atlantic Division also supplies strategic Thule AFB in Greenland. During 1953, Atlantic Division flew 208,648 passengers and patients and 38,526 tons of cargo and mail. Thule flights alone carried about 18,000 passengers and 5,500 tons of cargo. The Division plans to move soon to Dover AFB, Del.

• **Continental Division.** Maj. Gen. James S. Stowell commands this division from Kelly AFB, Tex. Its principal missions, in addition to air support, are air evacuation and training. Continental's operations also extend to Alaska, Canada and the Caribbean area. Its routes join with the Atlantic Division at Westover AFB and with the Pacific Division at Travis AFB, Calif. It carried 91,000 passengers and patients and 8,400 tons of cargo in 1953.

The three divisions during 1953 flew more than 1 billion passenger-miles 132 million patient-miles and 318 million ton-miles.

► **Routes**—Basic routes today are:

Mid-Pacific route from Travis AFB to Hawaii through Wake Island to Tokyo. Another route extends from Kwajalein to Guam, Manila and Saigon through India to Dhahran. The North Pacific route starts at McChord AFB, Wash., through the Aleutians to Tokyo.

North Atlantic route begins at Westover AFB through Newfoundland and Iceland to various points in Europe to Egypt and Dhahran. The other Atlantic route extends from Westover AFB through Newfoundland and the Azores to Scotland and Europe. Currently the Atlantic Division is running a passenger and cargo route from Westover to Thule AFB by way of Goose Bay, Labrador, and Sonderstrom AFB, Greenland.

Continental Division's basic aero-

medical evacuation route runs from Travis AFB to Kelly AFB to Brookley AFB, Ala., to Westover AFB.

Within the framework of these routes, MATS operates other routes and schedules as military requirements demand.

▶**MATS Planes**—Among the approximately 400 four-engine transport aircraft operated by MATS are the Lockheed R7V-1, fastest plane in the stable, the Boeing C-97, the Douglas C-74 (a MATS squadron at Brookley AFB operates all of these aircraft ever built), the Douglas C-124, the Lockheed C-121 and the Douglas C-118. Still a major factor in this airfleet is the Douglas C-54.

The twin-engine Convair C-131A will be added to the MATS fleet as an air evacuation plane in the very near future. It is the first aircraft with a special interior for aeromedical service.

Rescue craft include the Boeing SB-17 and SB-29, Grumman SA-16, Sikorsky H-5 and H-19, and the Piasecki H-21. Transition training planes are the North American T-6, Lockheed T-33, North American F-51 and Republic F-84; flight facility check plane is the Lockheed F-80. Other planes include: C-47, WB-29, B-25, B-26.

Backing up the MATS fleet of transport planes is the Civil Reserve Air Fleet Plan. CRAF calls for the mobilization of about 400 civil transport aircraft and crews into the MATS structure in the event of a national emergency.

▶**JCS Set Requirements**—Lt. Gen. Joseph Smith, who commands the entire MATS operation and its 100,000 military and civilian personnel from Andrews AFB, Md., is quick to point out that while MATS operates scheduled flights in the same manner as commercial airlines, his scheduled operations are based entirely on providing the airlift requirements directed by the Joint Chiefs of Staff. "The military situation determines the routes and schedules to be flown," he told AVIATION WEEK.

CHASE C-123

House Appropriations Committee, in a report on fiscal 1954 Defense Department funds, sharply criticized the MATS operation, stating that USAF directives had taken MATS far beyond its original mission of providing air transport for defense agencies. The committee claimed Air Force directives indicate that training and tactical support is the primary mission, and complained about the assignment of Air Rescue Service, Air Weather Service, Airways and Air Communications Service and Air Photographic and Charting Service as a MATS responsibility.

▶**Business Basis**—The committee strongly urged that MATS be limited to air transport operations, and that it be established on an industrial fund basis similar to Military Sea Transport Service. Defense Secretary Charles Wilson has approved the idea. MATS itself maintains a studiously careful position. "We will operate MATS just as we are directed by higher headquarters," a top staff officer said.

Gen. Smith is proud of MATS' operational readiness, and that no U.S. serviceman, wherever he may be stationed, is more than 60 hr. away from a U.S. hospital.

"We are doing in peacetime what we shall be called upon to do in time of war," Gen. Smith said. "Our democratic way of life will not support fully manned peacetime military machines. But it is imperative that we maintain forces-in-being—a hard core. This applies to all military branches.

"Other elements of the Air Force are in constant training during peacetime toward the military commitment if and when an enemy strikes. As any other military unit, we too are concerned in wartime with supporting our combat operations. But, where other elements are concerned primarily with training,

DOUGLAS C-124

BOEING KC-97G

Does temperature or pressure control enter into your design problems?

See how this bellows engineer can help you!

MR. D. D. GORDON, of our engineering staff, specialist in bellows applications.

● He'll work with you on a bellows assembly design for *your* specific requirements. He'll know the kind of bellows metal you need—brass, stainless steel, monel or nickel. He'll recommend the correct bellows charge —volatile liquid or gas.

He'll give you this and other important recommendations about bellows assemblies—to help your products perform more efficiently.

Sylphon and Bridgeport bellows assemblies are used in many ways—for thermostatic devices, pressure controls, hydraulic mechanisms, expansion joints, motion transmission, as flexible connectors and in more applications.

Let our engineers, our half-century of experience and ample production facilities work for you—save you valuable time and cut your costs. Write Department EA today.

TYPICAL SYLPHON AND BRIDGEPORT BELLOWS ASSEMBLIES

SEND FOR FREE BULLETIN

Idea-filled Bulletin tells you all about metal bellows and bellows assemblies. Send for your free copy today. Ask for Catalog 1400.

Robertshaw-Fulton

CONTROLS COMPANY

BRIDGEPORT THERMOSTAT DIVISION
BRIDGEPORT 1, CONNECTICUT

FULTON SYLPHON DIVISION
KNOXVILLE 1, TENNESSEE

we actually are fulfilling a peacetime military requirement."

► **Fly Super Connies**—MATS was established in June 1948 with the integration of the Air Transport Command and the Naval Air Transport Service. This was the first instance of combining two separate U.S. military services into a permanent organization.

The vice commander of MATS is a Navy officer—Rear Adm. T. B. Williamson. Four Navy transport squadrons (each roughly compares to a USAF group) are assigned to MATS. Two squadrons are based at Hickam AFB, one at Moffett NAS, Calif., and the other at Westover AFB. One of the Hickam squadrons flies R7Vs, the only Super Constellations assigned to MATS.

► **Technical Support Services**—Other side of the MATS operation is the technical support services which drew Congressional criticism for assignment to MATS. These include:

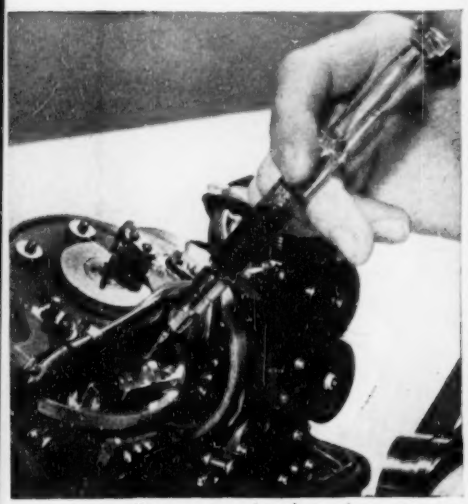
• **Air Weather Service.** This organization operates a worldwide meteorological service with detachments at all Air Force bases in the U.S. and abroad. Six reconnaissance squadrons, using WB-29s, are engaged in a constant search for vital weather information. They flew 11.2 million miles last year or about 56,300 flying hours. One squadron based on Guam made 105 penetrations into 18 typhoons. A force of 12,000 operates AWS' four weather centrals, seven forecasting centers, 253 forecasting units, 214 observing units and 68 upper-air units in 26 countries. It is commanded by Maj. Gen. W. O. Senter, scheduled to be replaced by Brig. Gen. Thomas Moorman in April.

• **Airways and Air Communications Services.** This unit operates more than 2,000 facilities from 250 strategic sites around the world. Duties include operation of fixed aeronautical point-to-point and ground-to-air radio stations, airport control towers, navigation aids, and message centers where weather information is collected and transmitted. Highlight of last year's operations was the installation of the first of many RATCC (radar air traffic control centers). These centers enable AACS to establish precise radar control of aircraft approaches to military fields. AACS is commanded by Maj. Gen. E. Blair Garland with headquarters at Andrews AFB.

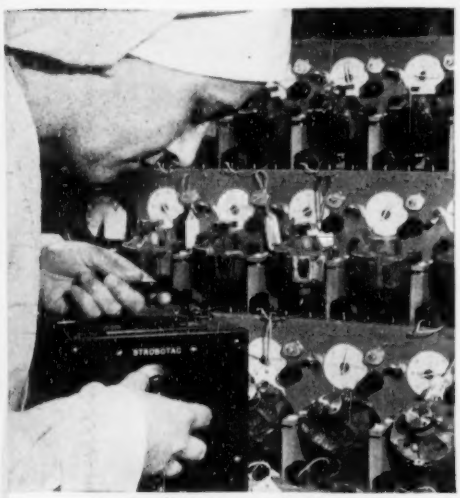
• **Air Photographic and Charting Service.** Production and distribution of charts, aeronautical publications and air target information are the prime responsibilities of APSC, which was assigned to MATS in April 1952. The unit also produced 131 reels of sound and silent film for USAF use in train-

...maximum strength
...minimum weight
...maximum speed
...minimum size
...THESE ARE THE
QUALITIES THAT HAVE MADE
FOOTE BROS. PRECISION GEARING
PREFERRED BY AIRCRAFT AND
AIRCRAFT ENGINE
MANUFACTURERS
FOOTE BROS.

Gyro assembly. Honeywell gyros are assembled in air conditioned, pressurized rooms guarded by a double air lock. To control lint and dust, workers are required to wear special caps and gowns.

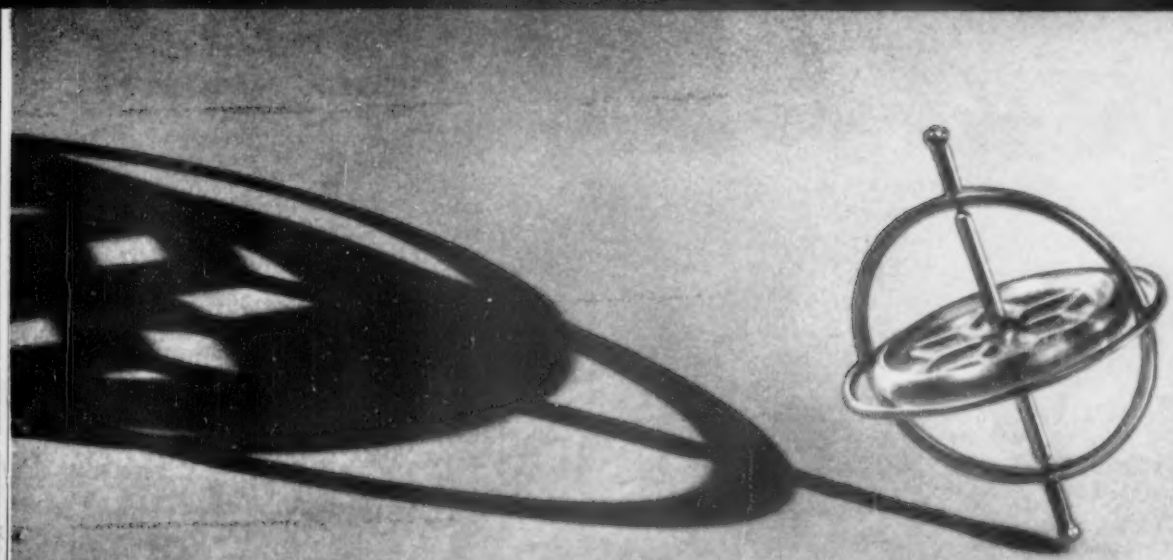


Extreme care is taken — in every gyro operation. Here a hypo needle is used by operator to perform minute operation — that of cementing a tiny mercury switch into its bracket deep inside a gyro.



Quality mass production means operations like this run-in test rack, where rotors are pre-tested for accuracy before gyro is completely assembled. Rack spins rotors at 21,000 rpm for 22 hours.

Got a job for an airborne gyro?



We have the gyro for the job

THE reason we can make this statement is that today at Honeywell we're *specialists* in gyros.

We are the leader in the field. With test and production facilities unequalled in the industry, we're tooled to produce thousands of precision gyros a month.

Honeywell's gyro line includes Vertical Gyros, Cageable Vertical Gyros, damped and undamped Rate Gyros and the highly sensitive, yet rugged line of fully floated Honeywell Integrating Gyros.

Our gyro "family"—which was originally developed for use in Honeywell aeronautical control systems—is now available to manufacturers who require *precision* performance. A letter to Honeywell Aero Division, Dept. 658, Minneapolis 13, Minn., will bring full details.

The Honeywell gyro "family" will continue to grow, as part of our complete line of controls for everything that flies. Because automatic control is important to aviation's progress. And *automatic control* is Honeywell's business.

MINNEAPOLIS
Honeywell
Aeronautical Division

2600 Ridgway Road, Minneapolis 13, Minn.

H
HONEYWELL

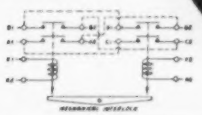
Leach

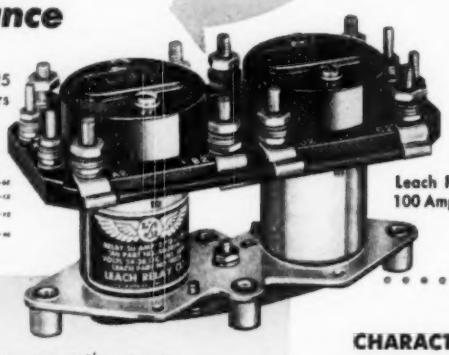
MOTOR-REVERSING CONTACTORS

for efficient performance

Leach Part No. 9025
50 Ampere Contactors

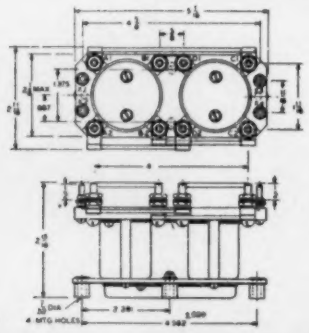
SCHEMATIC





Leach Part No. 9042
100 Ampere Contactors

DIMENSIONS



Leach motor-reversing contactors with mechanical interlock will improve the efficiency of your aircraft motor drives. These compact, rugged 50 and 100 ampere units surpass the most exacting military and commercial aircraft requirements. For motor reversing applications, these *Leach* precision-made contactors are preferred by major aircraft manufacturers because of their unsurpassed performance.

For your specific requirements and for BETTER CONTROLS THROUGH BETTER CONTACTORS—Specify Leach.

Write for new Brochures

CHARACTERISTICS

APPROVAL:
Approved as AN-3354-1 per Spec MIL-R-6106.
(Supersedes AAF type C-1).
CONTACTS:
Arrangement—Double pole, double throw, double break, normally open, mechanically interlocked.
Rating—50 amps resistive, inductive, and motor load at 29 v d-c.
COIL:
13 ohms, 24 v d-c intermittent duty (each coil).
Pick-up—7.5 v d-c max.
Drop-out—3 v + 0, —2.5.
WEIGHT:
1.65 lbs. approximate.

APPROVAL:
Approved as AN-3364-1 per Spec MIL-R-6106.
(Supersedes AAF type C-2).
CONTACTS:
Arrangement—Double pole, double throw, double break, normally open, mechanically interlocked.
Rating—100 amps resistive
80 amps inductive and motor load at 29 v d-c.
COIL:
10 ohms, 24 v d-c intermittent duty (each coil).
Pick-up—7.5 v d-c max.
Drop-out—3 v + 0, —2.5.
WEIGHT:
2.75 lbs. approximate.

LEACH RELAY CO.

5915 AVALON BOULEVARD • LOS ANGELES 3, CALIFORNIA
Representatives in Principal Cities of U.S. and Canada

ing and orientation. Brig. Gen. Edwin M. Day commands the organization at Orlando AFB, Fla.

• **Air Rescue Service.** Operating 43 squadrons which fly the SA-16, the H-5, H-19 and H-21 helicopters, and SB-17 and SB-29 lifeboat carriers, ARS provides a global search and rescue service for USAF crews involved in aircraft accidents. This service is also available for civilian aircraft crews and friendly foreign aircraft. During the Korean war the 3rd Air Rescue Group in Japan and Korea completed 9,680 rescues within the combat area. ARS is commanded by Brig. Gen. Thomas J. DuBose. Headquarters are scheduled to move from Washington, D. C., to Orlando AFB in April.

• **Flight Service.** This unit delivers flight plan messages to bases of destination within the U. S. This is accomplished through a network of interphone and teletype lines connecting all military and Naval bases, direction finding station, Civil Aeronautics Administration air route traffic control centers and air defense control centers. New communications will connect FS centers with all very-high-frequency and ultra-high-frequency direction finding stations. Pilot formerly could rely on receiving bearings from a single DFS, can now obtain advice through the new Flight Service DF evaluation centers. Col. Harry J. Bullis commands FS, which is also scheduled to move from Washington, D. C., to Orlando AFB.

► **Ferrying and VIP Service**—MATS also operates an aircraft ferrying service under the Continental Division composed of three squadrons—two jet and one piston engine—based at Dover AFB, Long Beach AFB, Calif., and Amarillo AFB, Tex. The ferrying squadrons last year delivered more than 7,000 aircraft in the U. S. and overseas.

The 1254th Air Transport Group, based at Washington's National Airport, handles the special—VIP—missions. One of the longest flights made by aircraft from the 1254th was Vice President Richard Nixon's goodwill mission. The Lockheed C-121 flew 169 hr. and traveled about 40,000 mi.

Another MATS mission is the support of the Strategic Air Command. Within hours after the Communists struck across Korea's 38th parallel, MATS was ordered to support the move of two SAC medium bomber wings to the Pacific. Two types of airlift are provided. First is the normal airlifting of SAC units supplies and equipment from the home station to the temporary duty SAC base. Second is en route support which provides service at MATS bases along the route to the destination. —GJMcA

SELF-PROPELLED ELECTRIC POWER PLANTS

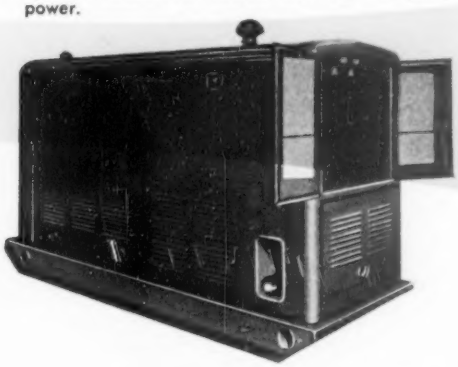
A mobile source of electric power for starting, servicing and towing aircraft, guided missiles and related equipment. The unit supplies both AC (400 cycle) and DC power and has a 5000 lb. drawbar capacity. Optional equipment,—compressed air (3500 psi); hydraulic power; torque converter, winterization equipment. These power plants are being supplied to the U.S. Navy and U.S. Air Force.

TEST EQUIPMENT, INSTRUMENT AND CONTROL PANELS

Electrical, hydraulic and mechanical test stands and portable testers to Military Standards and engineered to meet specific industrial needs.

GENERATOR SETS

Gasoline and diesel engine driven AC and DC generator sets from 5KW to 200 KW, skid or trailer mounted, open or housed. For aircraft servicing and general power.



AIRCRAFT GROUND SUPPORT EQUIPMENT

Consolidated Diesel Electric is a major supplier of ground support equipment for commercial and military aircraft. Consolidated equipment of all types is giving top performance in airports and air bases throughout the world.

In addition to standard units, special machines have been developed to solve complex servicing problems. Consolidated engineers are specialists in designing for the *advanced* requirements of the aviation industry.

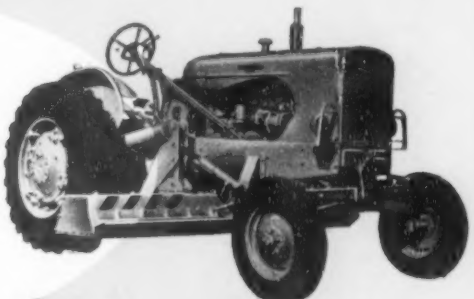
We are at your service to help fill your specific needs.

DIESEL & GASOLINE GENERATOR SETS—AIRCRAFT GROUND POWER SERVICING EQUIPMENT—MAGNETIC SWEEPERS—ENGINE DRIVEN FLOODLIGHT UNITS—SWITCHBOARDS—TEST EQUIPMENT—AIR COMPRESSORS & PUMPING EQUIPMENT—GUIDED MISSILE SERVICING AND LAUNCHING EQUIPMENT—RESEARCH & DEVELOPMENT—MOTOR GENERATOR SETS.

CONSOLIDATED DIESEL ELECTRIC CORPORATION

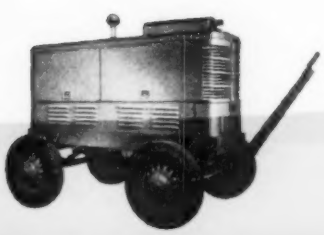
Aircraft Equipment Division

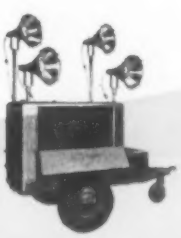
STAMFORD **CONNECTICUT, U.S.A.**

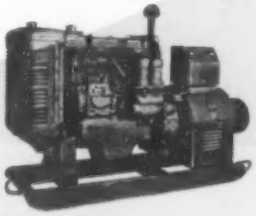


"MAGNA-SWEEP" SELF-PROPELLED MAGNETIC SWEEPERS

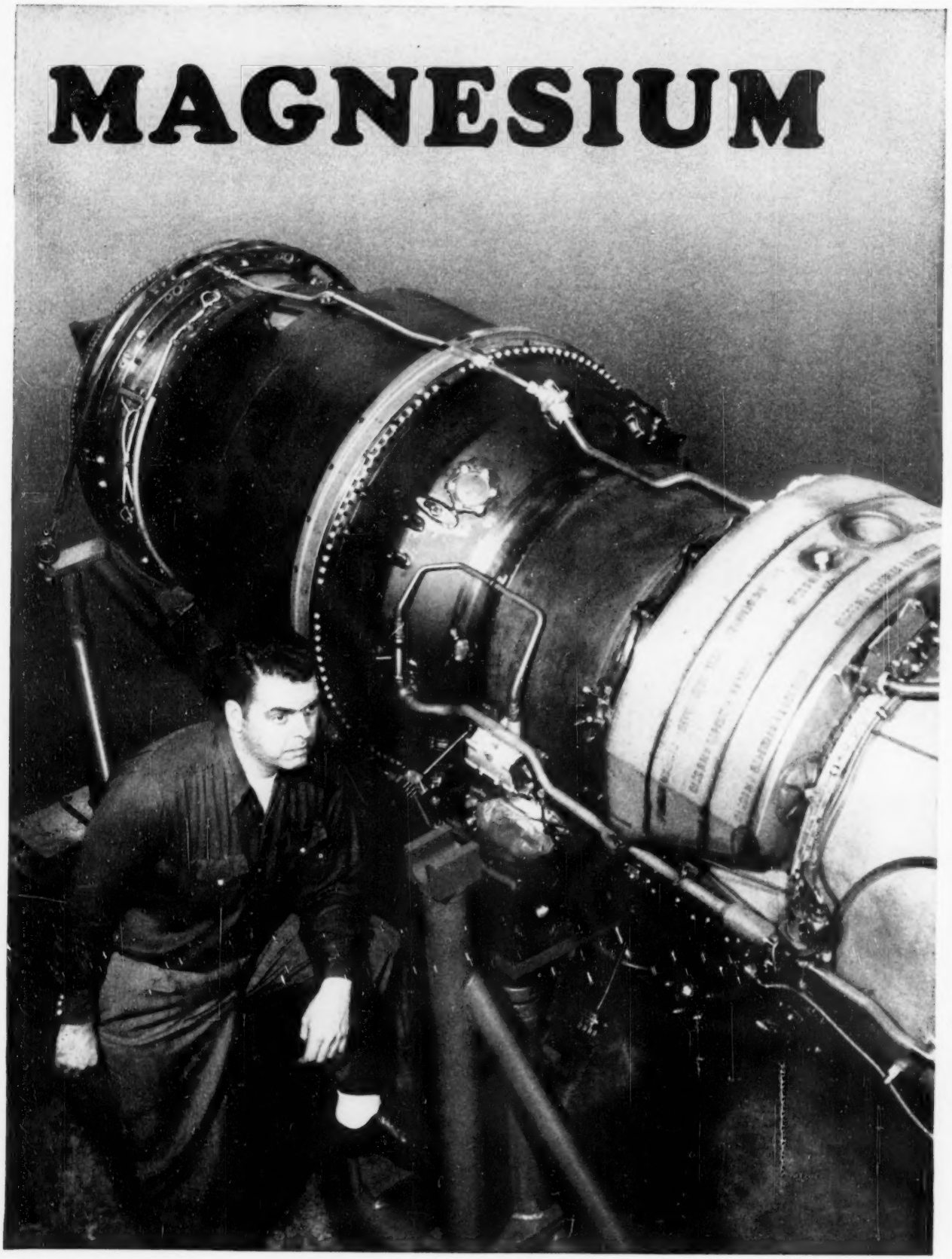
For cleaning Airports, Runways, Highways and Industrial Areas. Completely self-contained, with magnetic carrier, magnet, generator and control panel.







MAGNESIUM

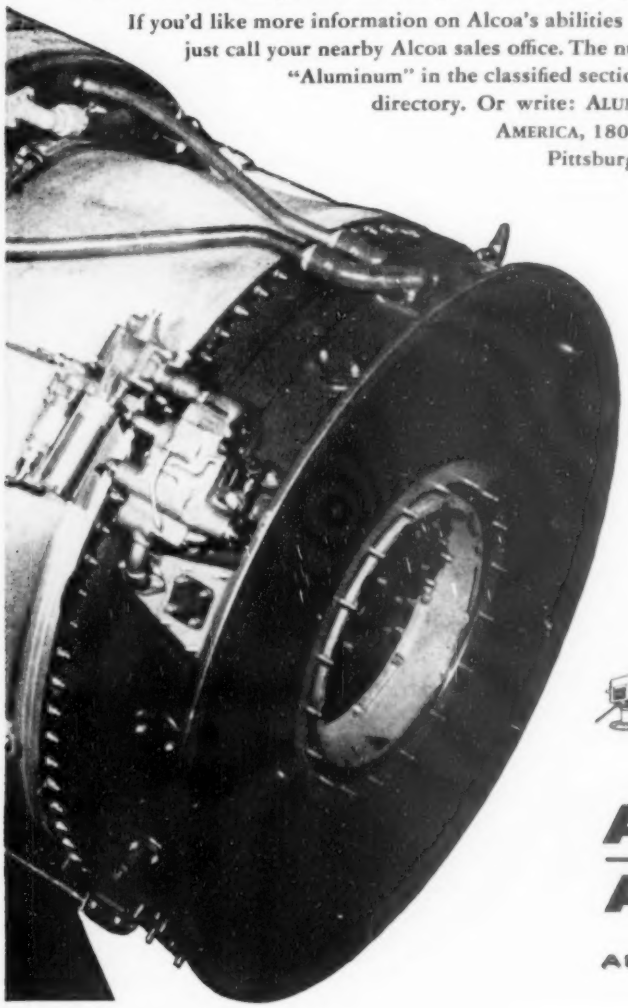


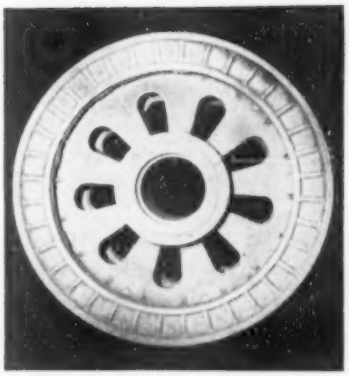
by ALCOA

Aircraft engineers are taking a second look at magnesium! Until recently, this metal was considered best for only minor castings—but sound technical advances have been made in alloying, heating and casting this modern metal.

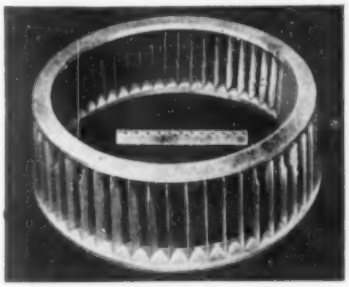
Today, Alcoa operates three magnesium foundries at Vernon, California, Cleveland, Ohio, and Buffalo, New York. At Alcoa's Buffalo Works, magnesium castings weighing upwards of three hundred fifty pounds are being cast! An example is the forward section of America's newest, most powerful jet engine in production—Pratt & Whitney Aircraft's revolutionary J-57. This leading engine builder makes full use of magnesium's strength and lightness. Other applications, too, like gear housings on giant helicopters, are cast of Alcoa® Magnesium. But size alone does not make these castings unique. Alcoa's team of magnesium experts also turns out tiny castings which weigh but a few ounces. The difference is team effort. From start to finish—from alloy selection to final inspection—these specialists watchdog every casting.

If you'd like more information on Alcoa's abilities . . . and facilities . . . just call your nearby Alcoa sales office. The number is listed under "Aluminum" in the classified section of your telephone directory. Or write: ALUMINUM COMPANY OF AMERICA, 1800-C Alcoa Building, Pittsburgh 19, Pennsylvania.

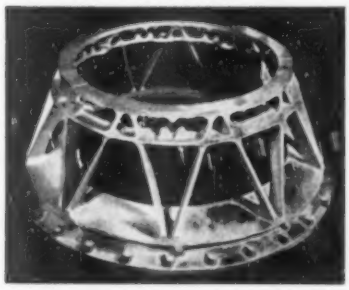




Extra-light aircraft wheels of Alcoa Magnesium—like this type, used on the Air Force's B-47 "Stratojet" bomber.



A challenge accepted by Alcoa—pouring the magnesium around stainless steel blades to form a solid, complex casting.



Another intricate job, this one a light weight engine support for a Pratt & Whitney Aircraft turbojet engine.

ALCOA ON TV brings the world to your armchair with "SEE IT NOW" featuring Edward R. Murrow, Tuesday evenings on most CBS-TV stations.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

SIGN OF THE TIMES...

for unlimited opportunities

Natural laws don't change . . . but engineering imagination and ingenuity find unique applications for them at Jack & Heintz. As a result, our *Rotomotive* devices—electrical, hydraulic and mechanical—solve many problems which have no precedent.

EXPERIENCED ENGINEERS

—seeking wider scope for their creative abilities—find, at Jack & Heintz, unparalleled opportunities on a wide variety of *aviation and commercial projects* in:

Design • Development
Manufacturing
Sales • Administration

YOUNG ENGINEERS

—recent graduates—can take advantage of a versatile, interesting training program specifically designed to uncover and develop individual specialization.

Send today—for your copy of *Time for Decision*, 24 pages of facts and pictures on why you'll be happier working at Jack & Heintz . . . your family happier living in suburban Cleveland.

Address: MANAGER
Technical Employment & Training

JACK & HEINTZ • Inc.

©1954, J & H, Inc.

17635 Broadway, Cleveland 1, Ohio

■ **AIR TRANSPORT**

Airfreight Faces Uphill Struggle

Despite gains in 1953 and rate rise late in year, profits are still marginal; cargo carriers fight for part in mail plan.

By Richard Balentine

Although 15% more freight was moved by the nation's air cargo industry in 1953 than in the preceding year, airlines were well aware at the end of the year that they still were involved in an uphill struggle.

Roughly 300 million ton-miles of freight was carried during the year. Profits were marginal for the big trunk airlines. The independent cargo carriers did not fare so well.

Big factor seemed to be that the industry still had a long way to go, because the airfreight business represented one-tenth of 1% of all cargo carried throughout the country during the year.

▶ **Profound Effect**—Four incidents occurred during 1953 which, by the end of the year, were beginning to have a profound effect on air cargo carriers:

- **Rate increase** averaging 12% in November.
- **Cutback** of the Pacific airlift.
- **Merger** of Flying Tiger Line and Slick Airways.
- **Postmaster General** Arthur Summerfield's mail experiment.

▶ **Marginal Returns**—Civil Aeronautics Board increased the airfreight tariff (AVIATION WEEK Nov. 2, p. 74) as proposed by Slick and Flying Tiger earlier in the year. Slick contended that, due to higher expenses, the present rates produced marginal-to-loss returns on all-cargo service despite high load factors.

However, the Board's order became effective Nov. 20, too late to have much effect on 1953's overall freight business. Even with the rate increase, trunk carriers saw little chance of bettering their profits in any great degree this year.

Emery F. Johnson, vice president and general manager of Air Cargo, Inc., said airfreight would increase only about 25% in 1954.

"You simply can't make money in the cargo business yet," he declared, adding that any increase is simply the sign of "natural growth" of the industry.

▶ **Airlift Phaseout**—Cessation of Korean hostilities in June forced a cutback in the Pacific airlift. By the end of the year, none of the trunk carriers were involved. Of the independents that had received military lift contracts, only California Eastern Airways, Overseas National Airways, Seaboard & Western and Transocean Air Lines remained.

By Mar. 31, all will be phased out as the Defense Department takes over the lift. Phaseout of the airlift will provide added capacity for commercial airfreight traffic during this year.

Loss of lift contracts by the other carriers involved placed some of the independent airlines in precarious financial positions.

▶ **Boon to Industry**—Merger of the two biggest independent all-cargo airlines, Tiger and Slick, was viewed as a boon to the entire airfreight industry. Because the merger was not approved by CAB until Jan. 7 (AVIATION WEEK Jan. 18, p. 80) it had little effect on the two airlines's 1953 business.

William E. Hollan, Slick vice president-sales and traffic, said, however, that 1954 would be the biggest year yet for the newly formed consolidated Flying Tigers company. Time spent by the two firms in fighting each other in the past now can be concentrated on fighting the competition of the big trunk carriers, he said.

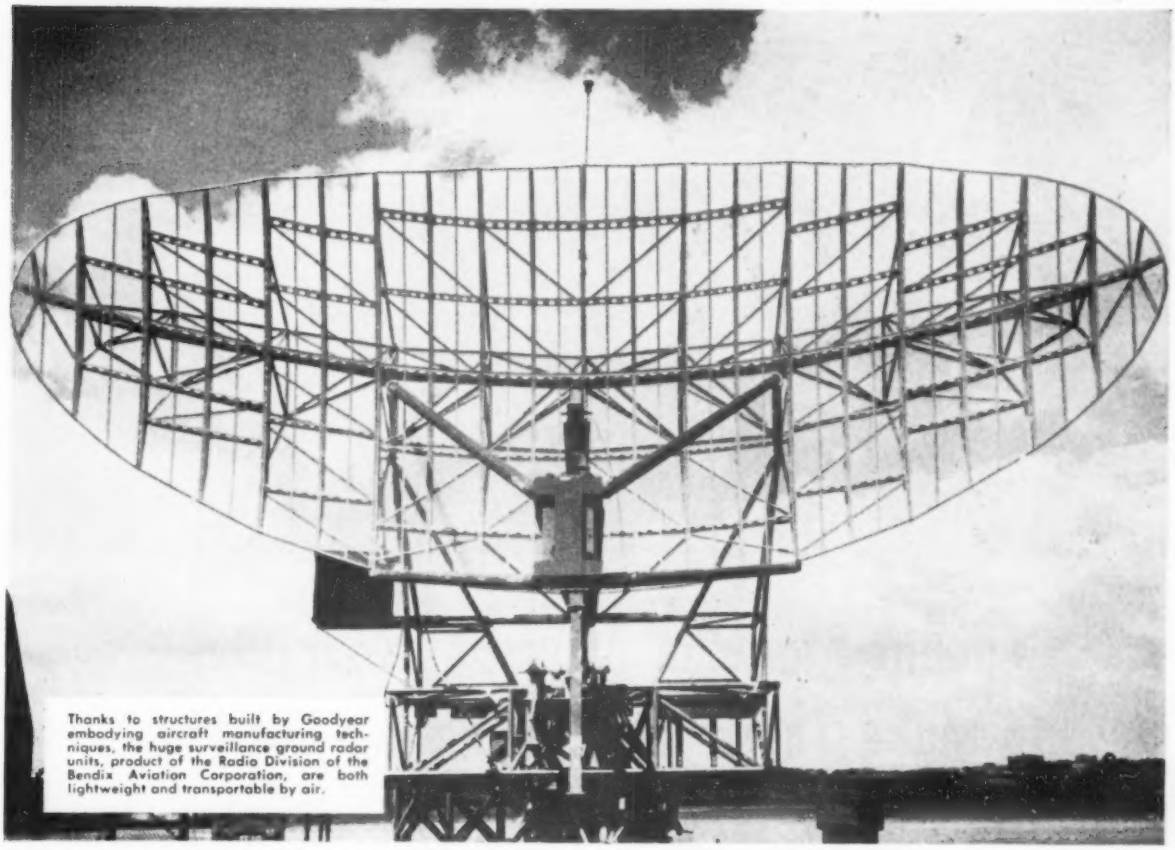
This, said Hollan, would bring about

Scheduled Airfreight—Revenue Ton-Miles (000)

	AMERICAN, TWA AND UNITED			FLYING TIGER, RIDDLE† AND SLICK	
	Express	Freight	Total	Freight	% of AAL, TWA, UAL Freight Figures
1950	23,117	76,597	99,714	60,084	78
1951	26,320	72,622	98,942	80,424	111
1952*	25,766	84,950	110,716	93,938	111
1953*	29,742	97,656	127,398	89,092	91

† Riddle freight services included before Mar. 24, 1951, are nonscheduled services only.
** 12 months ending Nov. 30th.*

SCOURGE OF THE STEALTHY!



Thanks to structures built by Goodyear embodying aircraft manufacturing techniques, the huge surveillance ground radar units, product of the Radio Division of the Bendix Aviation Corporation, are both lightweight and transportable by air.

To build a ring of radar around our far-flung perimeter of defense called for structures which could withstand arctic winds of 75 knots velocity, yet light and mobile enough to be shipped "knocked down" via air to remote bases.

Goodyear Aircraft teamed up with the company which had developed these long-range radar units to meet the need.

Goodyear's task was to build the support structures and the huge radar reflectors—"dishes" approximating 40 by 16 feet—yet the whole unit had to be rugged, lightweight and portable!

Aluminum-castings, tubular metals and special welding techniques were used to produce the frameworks—and today these new radar units stand guard as rugged sentinels along the Free World's rim.

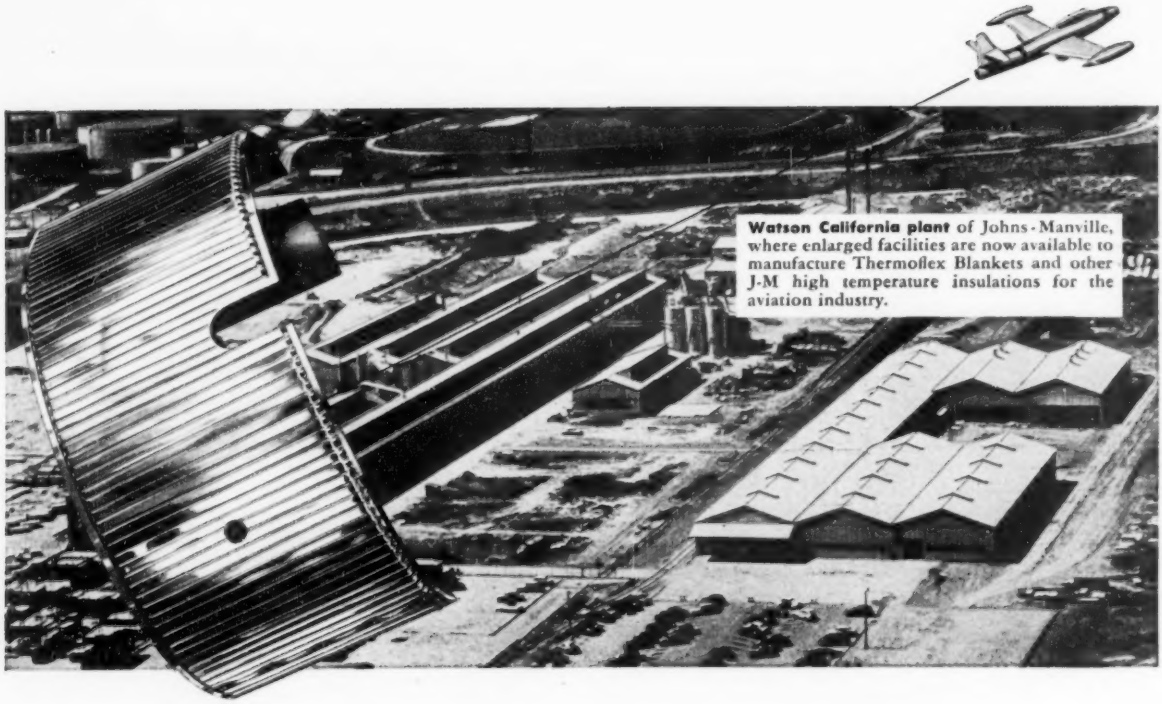
Building precision structures is an example of the kind of teamwork and versatility the aeronautics industry has come to expect from Goodyear Aircraft Corporation—producer of plastic canopies, fuel tanks, radomes, fuselage shells and major aircraft components as well as complete airships and airplanes.

Goodyear Aircraft Corporation, Akron 15, Ohio and Litchfield Park, Arizona

GOODYEAR AIRCRAFT

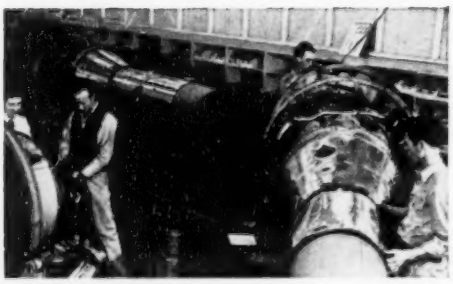
☆ *The Team To Team With In Aeronautics* ☆

We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network—THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

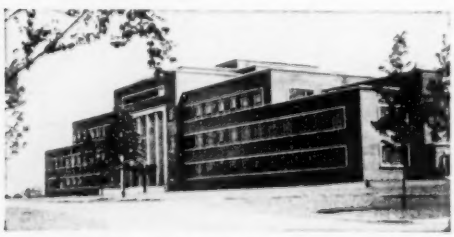


Watson California plant of Johns-Manville, where enlarged facilities are now available to manufacture Thermoflex Blankets and other J-M high temperature insulations for the aviation industry.

Johns-Manville expands production to make Thermoflex Insulating blankets



Precision-fabricated to your specifications, Thermoflex Blankets serve as insulations for tail pipes, engine cones, turbine casings and other assemblies. These blankets combine maximum stability, light weight and low thermal conductivity.



Backed by the World's largest insulation laboratory—located at the J-M Research Center, Manville, New Jersey. Both East and West Coast manufacturing facilities are co-ordinated with the design and technical services of this laboratory, to solve your thermal insulation engineering problems.

Enlarged facilities plus J-M insulation engineering service teamed to solve Aviation Industry's internal insulation problems

Johns-Manville has expanded its manufacturing operations to meet the aviation industry's increased demands for Thermoflex* Blankets. With its new production capacity at Watson, California—in addition to other manufacturing facilities at Manville and Roselle, New Jersey—Johns-Manville now has production facilities on both the West and East coasts.

These custom-made blankets, developed by Johns-Manville, have gained wide acceptance for insulating, protecting and fireproofing aircraft against the intense heat of jet power. Moreover, to meet present and future needs, other J-M high temperature insulations are available, and new and improved products are constantly being developed.

The aviation industry can also draw on the insulation design and engineering services offered by Johns-Manville. Through its technical personnel, Johns-Manville can help solve your thermal insulation problems . . . and specify insulating materials tailored to your most exacting needs.

You can avail yourself of this complete insulation engineering service simply by calling the nearest J-M district office. Or write to Johns-Manville, Box 60, New York City 16, New York.

*Thermoflex is a Johns-Manville registered trademark

Johns-Manville PRODUCTS FOR THE AVIATION INDUSTRY

an improved and flexible freight service for the company. Combined, the two airlines will make up the world's largest airfreight fleet, with four DC-6As, 11 DC-4s and 45 C-46s.

Together they carried nearly half of the freight flown domestically in 1953.

▶ **Successful Experiment**—Postmaster General Summerfield's experiment to fly a certain percentage of first-class mail by air between New York-Chicago and Washington-Chicago was pronounced so successful that it was extended last month to Florida.

Airlines now involved are American, Capital, Trans World, United, Delta-C&S, Eastern and National. Summerfield's experiment will have more effect on the volume of airfreight moved in 1954 than it had on 1953 traffic, since it was not begun until October of last year.

At the end of 1953, the all-cargo carriers were clamoring for participation in the mail plan. Robert W. Prescott, president of Flying Tiger, said of the experiment:

"It seems inconceivable that the all-cargo airlines will long be excluded from an experiment which promises so much by way of savings and improved mail service. . . . The airfreight industry is confident that some day, somehow the first-class and preferential mail will go by air, in cargo planes and at costs geared to cargo plane operation."

▶ **Airfreight Fleets**—Equipment-wise, the air cargo industry continued to use the older Curtiss C-46s, Douglas C-47s and C-54s, many leased from the Air Force, and the newer Douglas DC-6A. During the year, National returned its C-46s to USAF and replaced them with cargo-type Lockheed Lodestars.

Best bet for the present and immediate future appeared to be the DC-6A, cargo version of the DC-6 line. Air Cargo's Johnson said there is no market for a cargo-type craft at this time.

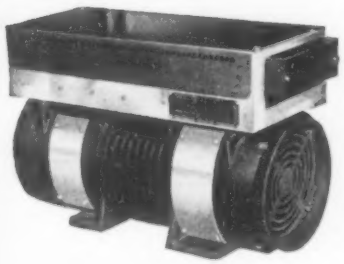
▶ **Billion Ton Miles**—Although airfreight appeared to be a slow-growing business in 1953, sales research experts in both airline and aircraft manufacturing companies predicted the billion-ton mile mark might be shattered by 1960.

Prescott, of Flying Tiger, was more optimistic. He said: "If the general business level stays at or near its 1953 highs, the airfreight industry should enjoy a record-breaking year of growth.

"Airfreight is, and should be, a separate industry, not a mere adjunct to the passenger business. It is a specialized service to meet specialized requirements. In fact, passenger traffic operations do not mesh well with freight flying, which explains in part the general lack of interest in airfreight development among combination carriers."

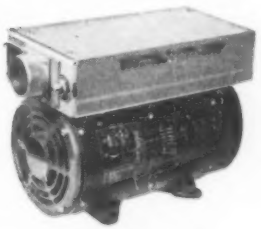
Bendix Red Bank

HIGH ALTITUDE INVERTERS



Type 32E03-3

Bendix Red Bank 32E03-3 and MG-54 Inverters give the continuous full AC power output needed to operate flight control instruments, radio communications and radar at today's higher altitudes and ambient temperatures. These two high altitude champions make the customary de-rating at higher altitudes unnecessary. They can deliver this outstanding performance because they have been specifically designed for high altitude operation and are not simply modernized versions of older designs. Further, their integral voltage and frequency controls enable them to hold the close tolerances required in modern aircraft.



Type MG-54

Specifications
Type 32E03-3
(Conforms to USAF drawing 53B6227 and AN-I-10b)

Input DC	
Voltage Range	26 to 29
Current Range	160 to 180
Current at 27.5 volts	165
Output AC	**Single Phase**
Volts	115 ± 4%
Amperes	21.7
Volt-Amperes	2500
Frequency-cps	400 ± 10
Power Factor	.9 lag to .95 lead
Efficiency	55%
200% load	5 sec.
150% load	5 min.

WEIGHT: Approximately 62 pounds.

MAXIMUM OVER-ALL DIMENSIONS: 7¼" wide x 11¼" high x 17" long.

ALTITUDE	AMBIENT TEMP. RANGE
Sea Level	−55°C to +85°C
35,000 ft.	−55°C to +40°C
50,000 ft.	−55°C to +20°C

Type MG-54
(Conforms to Navy drawing E-51A1A9 and MIL-I-7032)

Input DC	
Voltage Range	26 to 29
Current Range	24.1 to 21.6
Current at 27.5 volts	22.8
Output AC	**Three Phase**
Volts	115/200 ± 4% (115 ± 4%, single phase)
Amperes	1.25/.723 (2.17, single phase)
Volt-Amperes	250 (single phase, three phase, or single and three phase combined)
Frequency-cycles/sec.	400 ± 10
Power Factor	0.8 lag to .95 lead
Watts at 0.8 PF lag	200
Efficiency	40%
200% load	5 sec.
150% load	5 min.

WEIGHT: Approximately 17 pounds.

MAXIMUM OVER-ALL DIMENSIONS: 5½" wide x 8" high x 12" long.

ALTITUDE	AMBIENT TEMP. RANGE
Sea Level	−55°C to +85°C
50,000 ft.	−55°C to −10°C
65,000 ft.	−55°C to −10°C

Manufacturers of Special-Purpose Electron Tubes, Inverters, Dynamotors and Fractional HP D.C. Motors.

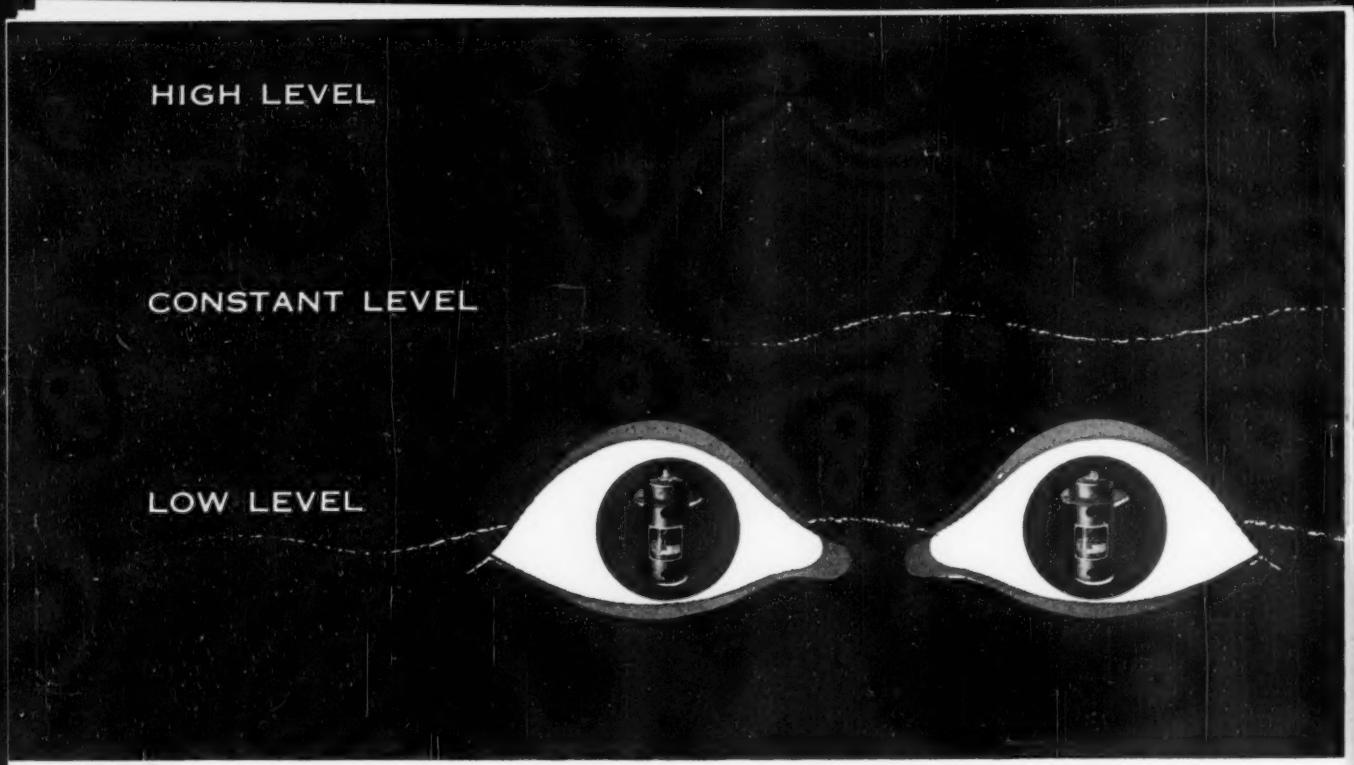
Bendix Red Bank

EATONTOWN, N. J.

DIVISION OF

THE FLAME Bendix AVIATION CORPORATION SYNONYMOUS WITH

West Coast Sales and Service: 117 E. Providencia, Burbank, Calif.
Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.
Canadian Distributor: Aviation Electric Ltd., P.O. Box 6102, Montreal, P. Q.

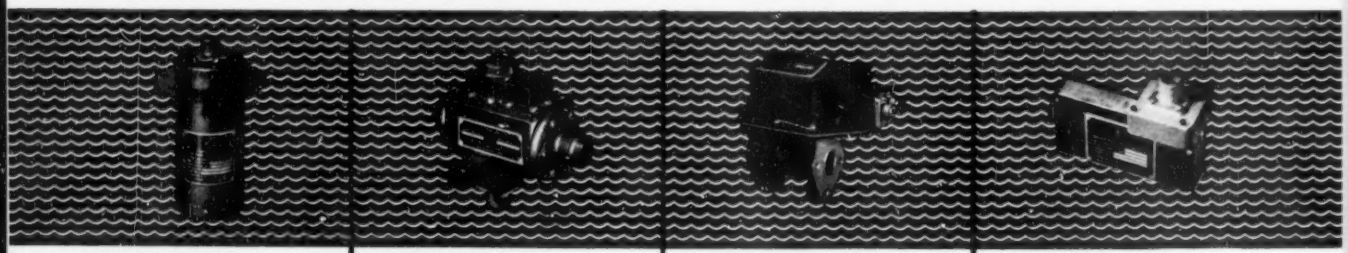


Revere INSTRUMENTS SEE WHERE YOU CAN'T

See Revere . . . if you need to know — **HOW MUCH LIQUID — HOW LITTLE — AT WHAT LEVEL.** *Revere's* precision made instruments are your unfailing eyes that see into sealed tanks, tubes or complex fuel lines. They can provide you with accurate measurement of liquid level regardless of pressure or temperature changes, vibration or rapid acceleration forces, AND they will automatically transmit a warning signal whenever liquid flow or level maintenance varies from a pre-determined value.

These hermetically sealed, magnetically actuated instruments employ balanced float assemblies to minimize false alarms. Compact and light, Revere instruments meet government specifications. They are available in many different configurations, some of which include relays to handle heavy electrical loads. Others are designed for complete submersion in fluids.

*Submit your control problem to our Field Engineering Department today. Revere will provide the instruments to tell you — **HOW MUCH — HOW LITTLE — AT WHAT LEVEL.** Shown below are some instruments that are the seeing-eyes of aircraft and industry.*



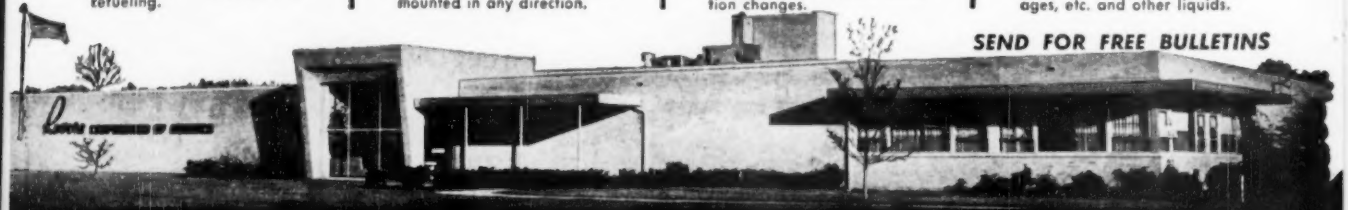
FLOAT SWITCH
Specially designed with single or dual float systems to provide automatic cut-off control for single point high pressure refueling.

FLOW SWITCH
Provides instantaneous warning signal whenever liquid flow falls below a pre-determined value. It can be mounted in any direction.

INDICATING SWITCH
Records the presence of fluid in a line whether stationary or flowing and transmits a warning signal if fluid condition changes.

FLUID LEVEL SWITCH
Used to maintain accurate high level, low level or constant level control of fuels, water-alcohol mixtures, beverages, etc. and other liquids.

SEND FOR FREE BULLETINS



REVERE CORPORATION OF AMERICA

WALLINGFORD 2, CONNECTICUT, U. S. A.

precision instruments for aircraft and industry

Supersonic Research Looks for New Answers as . . .

Speeds Get Higher, Problems Tougher

Two dramatic highspeed flights marked significant points in aeronautical engineering progress during 1953:

• Faster than any research aircraft had ever flown, the Bell X-1A rocketed Maj. Charles Yeager to a speed of Mach 2.5.

• Faster than any military prototype had ever flown, North American's YF-100 Super Sabre slammed through sonic speed and into the supersonic range under the guidance of senior engineering test pilot George Welch.

These tremendous speed strides, made possible by teams of industry, military and government pilots and technicians, have highlighted these factors underlying aircraft research and development today:

• Drag reduction is more important than ever. Very small changes in drag can be responsible for speed changes measured in hundreds of miles per hour.

• Flight technique can make the difference. The Douglas Skyrocket reached Mach 1.86 under the capable hands of Bill Bridgeman during the company's phase of the flight test program. After long study and minute planning of an optimum flight path and technique by a flight-test team, NACA's Scott Crossfield took the same Skyrocket, unchanged, to Mach 2.01.

• Windtunnel tests can lead directly to tangible hardware. One big industry complaint in the past has been that NACA did nice basic work, but as for design data it left something to be desired. Now, North American's F-100 design owes its inboard ailerons, inlet lip shape and low-positioned tail to recent hours of windtunnel time at the National Advisory Committee for Aeronautics.

These are credits on the aerodynamic ledger.

Problems

The debit column still has too many items to suit most engineers and scientists who keep watching the trend of development in the U. S.

• Lateral stability. One of the big problems is that supersonic airplanes are running out of lateral stability. The reason is an aerodynamic fact: The slope of the lift curve decreases with increase in Mach number. This means that a given change in wing angle of attack produces a lot less lift at Mach 3 than it does at Mach 1.3. It's this wing lift—applied differentially with ailerons or by dihedral effect—that makes an airplane controllable or stable in roll. If that lift is not available, you find yourself in the wild predicament that Bridgeman experienced in Skyrocket flights when a wing dropped in supersonic flight and he couldn't pick it up with the ailerons, couldn't turn, couldn't recover. He finally recovered by using full tab deflections.

• Noise. Another problem: What can be done about noise? This single question promises to cost more in time and money than many of the knotty problems of the past. It seems to be impossible to go fast, or to produce great amounts of power from moving air, without making an awful racket.

Military and civil aircraft alike are going to be increasingly noisy about their business, and the prospect of a jet transport in full cry over apartment roofs on Long Island has appalled civic authorities.

Something has to be done. The plain fact is that right now, nobody knows what to do. Further, nobody seems to know in which direction to go in order to find something to do.

So there are problems. If you want to talk aeronautical problems, the people to talk to are the scientists and engineers of the National Advisory Committee for Aeronautics.

NACA

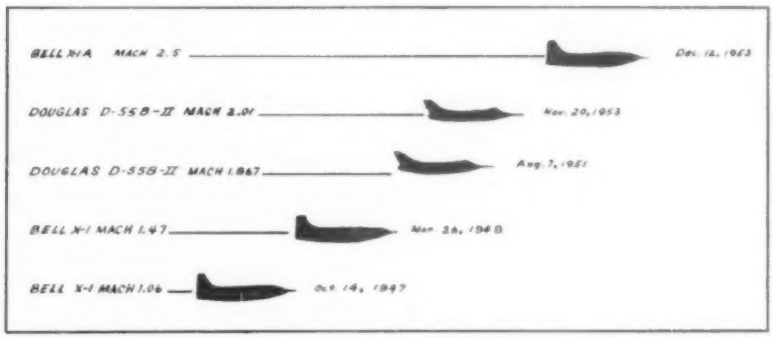
Established by act of Congress in 1915, NACA has almost sole control over aeronautical research and experiments in this country. Their job:

• ". . . To supervise and direct the scientific study of the problems of flight with a view to their practical solution."

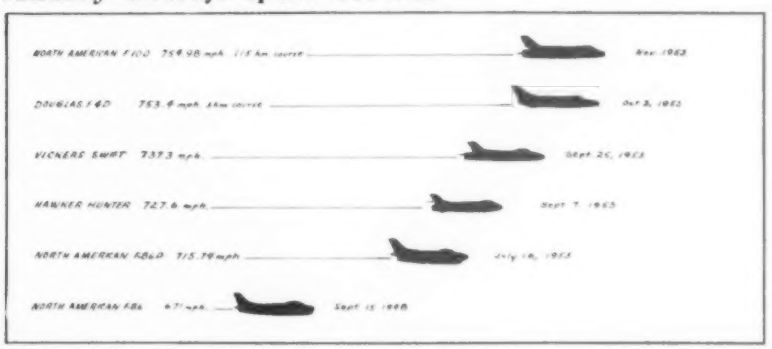
• ". . . To direct and conduct research and experiments in aeronautics."

Today one big trend in NACA's laboratories is the integration of the airplane and its avionics. Willy-nilly, NACA is getting drawn into the systems business. This was inevitable, be-

Research aircraft speed marks


BELL X-1A MACH 2.5 Dec. 12, 1953
DOUGLAS D-558-II MACH 2.01 Nov. 20, 1953
DOUGLAS D-558-II MACH 1.867 Aug. 7, 1951
BELL X-1 MACH 1.47 Nov. 20, 1948
BELL X-1 MACH 1.06 Oct. 14, 1947

Military aircraft speed records


NORTH AMERICAN F-100 Nov. 1953
DOUGLAS F4D Oct. 3, 1953
VICKERS SWIFT 737.3 m.p.h. Sept. 25, 1953
HAWKER HUNTER 727.6 m.p.h. Sept. 7, 1953
NORTH AMERICAN F8D 715.79 m.p.h. July 16, 1953
NORTH AMERICAN F8L Sept. 15, 1948

EXTRA!

Huck Manufacturing Company announces the high shear, high tensile, heat resisting and corrosion resistant stainless steel Deutsch drive pin blind rivet than can be installed with an ordinary hammer by one person from one side of work.

Deutsch

Drive Pin Blind Rivet Features

1. Drive with ordinary hammer.

2. Installed by one person from one side of work.

PLACE RIVET INTO HOLE IN MATERIAL.

3. Available from stock in both countersunk and brazier heads.

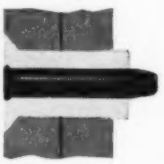
4. Stocked in 3/16", 1/4", 5/16" and 3/8" diameters, other sizes to order.

DRIVE RIVET PIN WITH HAMMER.

5. High shear strength—75,000 PSI minimum guaranteed.

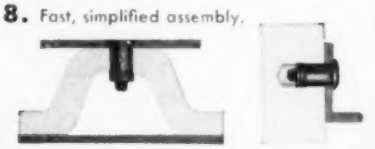
6. High tensile strength, excellent sealing qualities and low weight.

PIN DRIVEN, SLEEVE EXPANDED TO FORM BLIND HEAD, AND PIN LOCKED IN SLEEVE.



7. Heat and corrosion resistant.

8. Fast, simplified assembly.



FORM NO. F-255

Deutsch Drive Pin Blind Rivets can be used in buried rivet applications, double construction or wherever you want a simple, strong and dependable blind rivet. When you think of fasteners, think of

Huck MANUFACTURING COMPANY
2480 BELLEVUE AVE., DETROIT 7, MICH.

■ ENGINEERING

cause airplanes themselves have become part of systems. It was careful consideration from a systems viewpoint that enabled NACA planners to get more out of the Skyrocket when nobody felt there was any more to get.

With the increase of systems study, the importance of the engineering test pilot increases. NACA's pilot staff has always accented the ability to do much more than horse the controls around.

The old-line test pilot came back from a flight and reported the effect. Today's engineering test pilots report the cause as well as the effect.

► **Engine Integration**—More than ever before, the engine of any airplane has to be considered as part of a flow system that begins to intercept air well ahead of the airplane, gulps it in huge quantities and exhausts it rapidly downstream. Every inch of the way, the moving air is doing something to the airplane or engine, and it is almost impossible to separate one effect from the other.

Part of NACA's powerplant work is combustion experiments; the results will help improve high-altitude performance of our engines during the next few years.

Another area where much remains to be done is in afterburner design. NACA regards the design of afterburners as an empirical task. Afterburner noise has another aspect in addition to its ear-shattering qualities: it is destructive to the afterburner.

There are two kinds of this noise; rumble (which is motion of the flame front amplified by the geometry of the tailpipe) and screeching. It's the latter that tears the guts out of an afterburner, and one of NACA's big programs now is aimed at understanding the screech and doing something about it.

► **Configuration Studies** — Generally NACA doesn't test specific design configurations. It inclines toward stability studies of a delta wing, not the F-102 layout; it measures deflections of a swept wing, not the B-52 panels.

But NACA influence makes itself felt in airplane design. There are the three cases quoted for the North American F-100—intake lip shape, inboard ailerons and low horizontal tail.

Wing trickery in the form of leading edge extensions, fences, flaps and slots have come out of tunnel tests at Langley and Ames.

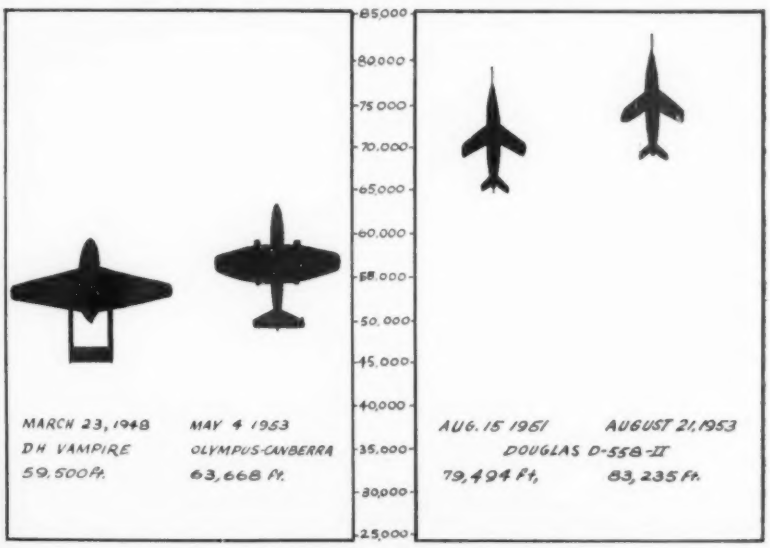
One layout, which was evolved with the low horizontal tail as an answer to stability problems at high speeds, places the engine farther aft and lower than is common now. So far no designers have picked this one up, but it's a safe bet that it won't be long now.

► **Noise Studies**—NACA scientists are vitally concerned with the noise problem. They got into it when they first started operating wind tunnels near inhabited areas, and they've been in the heart of the problem ever since.

Today there are several spearheads leading the attack on the noise problem. Lewis laboratory scientists are working with empirical approaches; they drew the assignment because they promised to have a fresh approach. These men formerly worked on aircraft crash fire studies; none of them previously had anything to do with either crash or fire studies. Their approach was fresh, their contributions huge.

Massachusetts Institute of Technology and its western counterpart, Cali-

Altitude marks, military and research



LEWIS

Complete Temperature Measuring Systems for Aircraft

. . . Sturdy
. . . Accurate

Hermetically Sealed TEMPERATURE INDICATORS
TO "AN" AND AIR FORCE SPECIFICATIONS

THERMOCOUPLE THERMOMETERS
STANDARD RANGES FOR CYLINDER, BEARING OR EXHAUST TEMPERATURES

2" SINGLE INDICATORS
WITH MOUNTING BEZEL

2¾" DUAL INDICATORS

2" SINGLE INDICATORS
FOR RING CLAMP MOUNTING

RESISTANCE THERMOMETERS
STANDARD RANGES FOR CYLINDER, OIL, FREE-AIR, COOLANT, CARB-AIR OR HEATING DUCT TEMPERATURES

2" SINGLE INDICATORS
WITH MOUNTING BEZEL

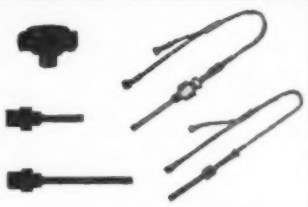
2¾" DUAL INDICATORS

2" SINGLE INDICATORS
FOR RING CLAMP MOUNTING

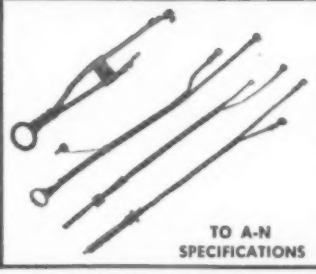
RESISTANCE BULBS — STURDY . . . FAST-ACTING

THERMOCOUPLES — ACCURATE . . . RELIABLE

THERMOCOUPLE WIRE — AIRCRAFT QUALITY . . . FROM OUR OWN WIRE MILL



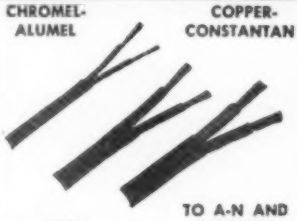
A-N, FREE-AIR, STUFFING-GLAND
AND CYLINDER-HEAD BAYONET TYPES



TO A-N
SPECIFICATIONS

CHROMEL-ALUMEL

COPPER-CONSTANTAN



IRON-CONSTANTAN

TO A-N AND MILITARY SPECIFICATIONS

TO INSURE ACCURATE, RELIABLE TEMPERATURE INSTRUMENTATION, USE LEWIS BULBS, THERMOCOUPLES, LEAD WIRE, FIREWALL BLOCKS, RESISTORS AND INDICATORS

THE LEWIS ENGINEERING CO.

NAUGATUCK, CONNECTICUT

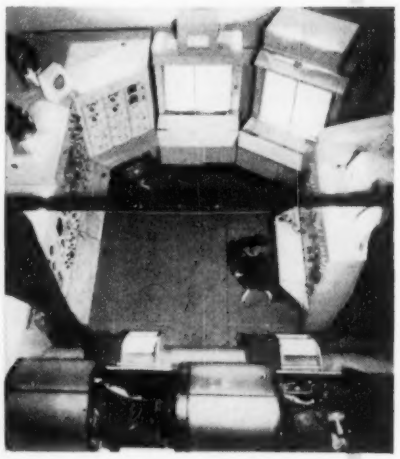
Manufacturers of Complete Temperature Measuring Systems for Aircraft

25 YEARS OF SIMULATED FLIGHT

THEN

The Link Trainers of yesteryear pioneered the way for flight simulation on the ground. Their development and effective use in expediting the training of military and commercial airline pilots made "Link time" a requisite in each pilot's curriculum.

NOW



Modern flight training places even greater emphasis on simulated flight. New electronic jet simulators, such as Link's ultra-modern F-89D, right, now being delivered to the United States Air Force, reflect the Link company's continuing leadership in the flight simulator field.

AND YET TO COME . . .

As the age of powered flight enters its third quarter of a century, and Link begins its second, the research laboratories of LINK are already at work to meet the military and commercial requirements of the fast-advancing Age of Flight.

25 YEARS OF SIMULATED FLIGHT

LINK AVIATION, INC.
BINGHAMTON, N. Y.

fornia Institute of Technology, have contracts from NACA for analysis of sound. At the other extreme, NACA is paying for opinion sampling of noise levels found in everyday life. NACA believe that if it can find out what kinds of noise are objectionable and why, it at least will have begun to define the problem.

► **Other Fields**—A look through the NACA's annual report—which is an unclassified summary of reports issued during the year—shows unusual variety in the number and kinds of research studies.

In tests of maximum lift coefficients, tunnels run at a speed which a decade ago was maximum speed for lots of airplanes. Now it is the landing speed for some.

Minimized propeller noise has been added as a parameter to the traditional form of propeller selection charts. You can select a prop for transport airplanes up to a flight Mach number of 0.8 and for any engine between 1,000 and 10,000 hp.

There is emphasis on fuel development to increase performance of the airplane by virtue of the chemical properties of the fuel.

Fuel sloshing in wing tanks can be a help in reducing flutter or buffet, if you can count on having the fuel there all the time. How much help will the fuel give? NACA has started to find out.

Aerodynamic heating may be a blessing in disguise in some limited cases. For instance, it can keep a wing from icing. There are drawbacks: liquid water will run back and freeze anyway. So NACA has a technical note presenting a quick method for calculating the icing limit at altitudes up to 45,000 ft. and speeds to Mach 1.8.

► **Research Takes 7,000**—The future paths of aeronautical progress are charted by the 7,000 technical and administrative people who make up the NACA, and populate its Washington headquarters and three main facilities:

• **Lewis Flight Propulsion Laboratory, Cleveland.** Here the entire spectrum of flight propulsion is painted in high-altitude test cells and windtunnels, on static test stands and in shops.

• **Ames Aeronautical Laboratory,** Moffett Field, Calif. Aerodynamic research is the job here. The world's largest windtunnel and some of the world's fastest share the acreage.

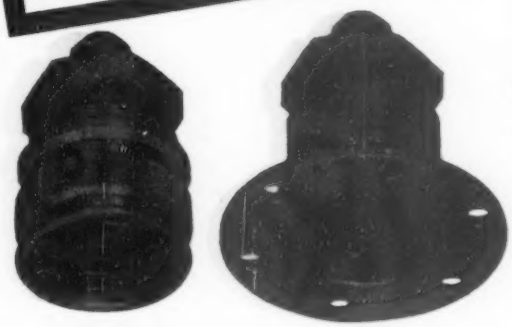
• **Langley Aeronautical Laboratory,** Langley Field, Va. This is the "general problem" lab, where aerodynamics and structures, hydrodynamics and design ideas are the order of the day.

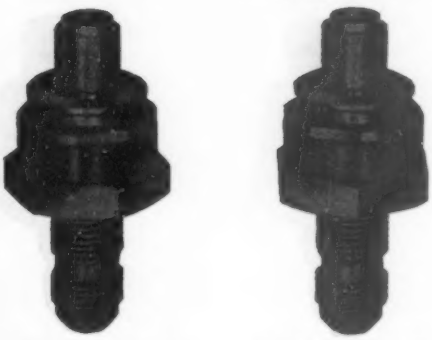
Then there are two NACA sub-stations of science. At Wallops Island,

ANNOUNCING

WIGGINS INST-O-MATIC COUPLINGS

3000 PSI





Manual Quick Disconnect
(Push-Pull
Positive Action)

Automatic Quick Disconnect
(Breaks Away at
Pre-determined Weight Load)

HERE ARE THE HYDRAULIC "SELF-SEALING" QUICK-DISCONNECT COUPLINGS YOU HAVE BEEN WAITING FOR

FEATURES

Disconnects under system pressure
Light weight · Compact · Positive
Safe

SIZE RANGE

$3/16" - 1/4" - 5/16" - 3/8" - 1/2" - 5/8" - 3/4"$

OTHER HIGH-PRESSURE COUPLINGS ALSO AVAILABLE:

FOR PNEUMATIC SYSTEMS

FOR BALLISTIC SYSTEMS
(such as seat and canopy ejectors)

Also AUTOMATIC BREAK-AWAY COUPLINGS
(for drop-tank systems)
AND REMOTE ACTUATED COUPLINGS
(for missile use)

Write for further information

Wiggins

E. B. WIGGINS OIL TOOL COMPANY, INC.
3424 East Olympic Boulevard, Los Angeles 23, California

REPRESENTATIVES: AIRSUPPLY COMPANY: Offices in Los Angeles, Seattle, Wichita, Ft. Worth, Tulsa, Kansas City, and San Diego. **AERO ENGINEERING, INC.:** Akron, Indianapolis, Mineola, N.Y. Baltimore. **HARVEY PIPE:** Dayton. **G. S. GROVES:** Cleveland. **G. R. CARRIER:** Chicago. **CHARLES MORGAN:** Boston. **AERO SALES ENGINEERING, LTD.:** Montreal.

IMMEDIATE CAPACITY AVAILABLE

Whether you are designing aircraft parts, electronic components or major fabrications, Roland Teiner has the facilities, man power and special Technical skills to work with your engineers and designers on tough problems.

For all-gage — any metal — any quantity, manual or automatic spinning, roll forming, hydroforming or completely fabricated components or products, look to Roland Teiner for early delivery. Send blue prints or drawings for quotes, or write for reprint of article titled "Deep Drawing of Intricate Shapes."

Save time and money — call Teiner now

ROLAND TEINER CO. INC. METAL SPINNING

ROLAND TEINER

COMPANY, INCORPORATED

134 TREMONT ST., EVERETT 49, MASS. Tel. EV 7-7800

Engineering Offices: Chicago, Cincinnati, Detroit, Fort Worth, Kansas City, New York, Los Angeles

off the Virginia coast, rocket-propelled models scream skyward over the Atlantic in highspeed tests of wing shapes, telemetry equipment, stability and control parameters.

At the Air Force Flight Test Center, Edwards AFB, Calif., the NACA has its hangar and taxiway and flight crews.

There are research subcontracts that NACA lets out to specialized groups across the country to tackle some phase of work especially suited to their talents. Among them: Massachusetts Institute of Technology, California Institute of Technology, Battelle Memorial Institute, Johns Hopkins University, the National Bureau of Standards.

In 1953, the Committee used about $58 million of its appropriated funds, carrying over an unobligated balance of about $8 million. The bulk of this money—about $48.5 million—went directly into salaries and expenses of the laboratories, the substations and the subcontracts.

► **Unitary Plan**—First of the NACA tunnels to be operated under the so-called Unitary Plan will start testing this year. Planning for the Unitary scheme began in 1944 and stretched into 1947 as representatives of government and industry met with those of NACA. They hammered out a proposal for a coordinated plan for windtunnel procurement.

The plan was considered, reconsidered, cut down, and finally legalized in Public Law 415 of the 81st Congress. It had started at a cost level of more than $2 billion, comparable to the first atomic bomb costs. It was pared down finally to a group of appropriations totaling about $500 million.

When the planning began, maximum speed of airplanes was a little over 500 mph. Next year when the first tunnel starts moving air, the speed record will stand at more than three times that figure.

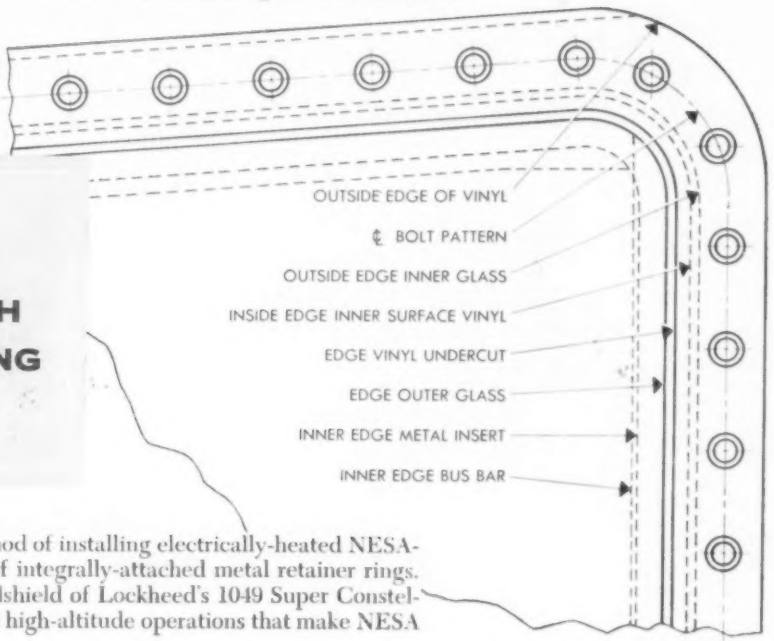
The NACA annual report has this to say about the problems tomorrow: "The lack of mathematical methods for predicting theoretically aerodynamic behavior in the speed ranges of tomorrow's aircraft means that this kind of information must be obtained through use of experimental techniques, the most satisfactory of which requires use of the large wind tunnel of the kind being provided under the Unitary Windtunnel Plan.

"Before the end of 1954, the first of the Unitary Plan supersonic windtunnels will be in fruitful use as a tool in the hands of America's producers of supersonic aircraft and missiles. The planning of a decade ago began not a moment too soon."

How the windshield panels of Lockheed's Super Constellation are glazed with electrically-heated "NESA" Glass

A report from

THE PITTSBURGH AIRCRAFT GLAZING FILE

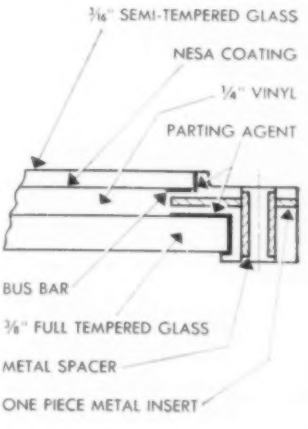


THESE drawings show you a method of installing electrically-heated NESA-coated Glass without the use of integrally-attached metal retainer rings. They are details of the center windshield of Lockheed's 1049 Super Constellation, a plane with high-speed and high-altitude operations that make NESA Glass particularly suitable.

The NESA windshield used here consists of one piece of semi-tempered and one piece of full-tempered glass with a vinyl filler between. Electrical current, carried by the NESA coating of the inboard surface of the outboard glass, prevents ice formation and gives freedom from frost and fogging. NESA is also used on the adjoining forward glass areas, and the other four cockpit openings are glazed with Pittsburgh Flexseal.

The vinyl surface is undercut to achieve flush mounting of the external retainer ring. This method of installation permits the use of narrow posts that provide the least possible obstruction to vision. This bird resisting assembly is engineered for maximum "double" safety as the vinyl filler is capable of carrying flight loads and the pressurization of 4.5 p.s.i. even though one or both pieces of glass were accidentally broken.

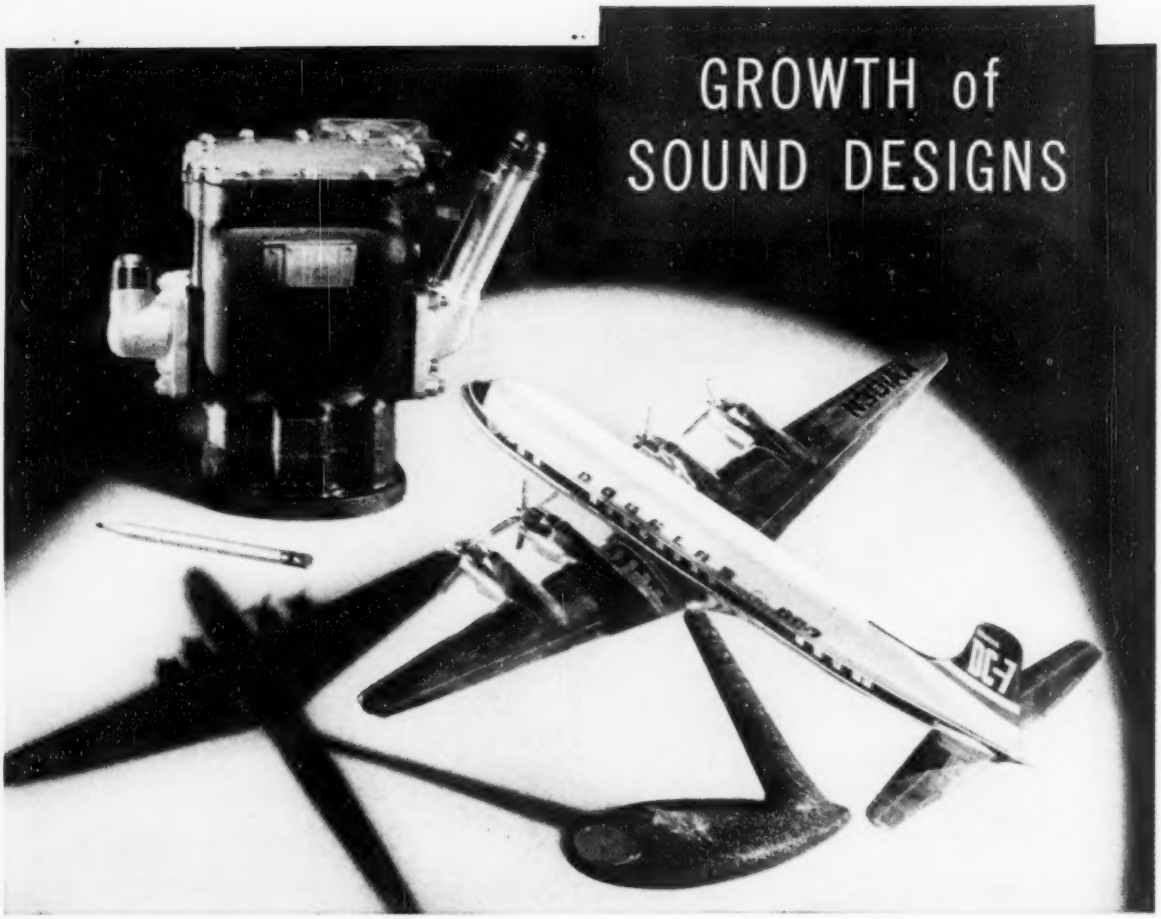
Working together, Lockheed engineers and Pittsburgh Plate Glass Company technical representatives designed this installation, and the same kind of technical assistance is available to you from Pittsburgh representatives. Your glass and glazing problems will be carefully considered in the light of our years of experience with the nation's major aircraft manufacturers. For complete information, write to Pittsburgh Plate Glass Company, Room 4184, 632 Fort Duquesne Boulevard, Pittsburgh 22, Pa.



PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS · FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED



New DOUGLAS DC-7 Uses New VICKERS® Variable Displacement Hydraulic Pumps

Cabin supercharger drives on the new Douglas DC-7 use the largest known variable delivery aircraft hydraulic pump . . . the new Vickers PV-3918. Like the DC-7, the PV-3918 is an outgrowth of previous successful designs.

This pump is a development from similar but smaller pumps used in the DC-6, DC-6A and DC-6B. The basic application was so successful it was adopted for the new DC-7. The new pump provides a 147% increase in flow capacity with only a 50% increase in weight. A special feature of the PV-3918 is an overspeed control which automatically limits the maximum pump delivery and accordingly provides another safety check on compressor impeller speed.

For further information about the numerous advantages of Vickers Variable Displacement Piston Type Pumps, ask for Bulletin A-5203.

VICKERS
Incorporated
DIVISION OF THE SPERRY CORPORATION
1462 **OAKMAN BLVD. • DETROIT 32, MICH.**

Application Engineering and Service Offices: El Segundo, Calif., 2160 E. Imperial Highway • Houston 5, Texas, 5717 Kirby Drive
Detroit 32, Michigan, 1400 Oakman Blvd.
Additional service facilities at:
Miami Springs, Florida, 641 De Soto Drive

6650

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

U. S. RESEARCH PLANE FLEET (reading clockwise from lower left): Bell X-1A, Douglas D-558-I, Convair XF-92A, Bell X-5, Douglas D-558-II, Northrop X-4. Douglas X-3 is in center of group. Specifications of these airplanes are in table below.

U. S. RESEARCH AIRCRAFT

Manufacturer and Address	Designation	Seats	Number, make, model, and power of engine	Maximum speed (mph)	At altitude (ft.)	Gross weight (lb.)	Span	Length	Height	Remarks
Bell Aircraft Corp. *Buffalo, N. Y.*	X-1	1	1 RMI-6000-C-4 @ 6,000 lb. t.	1,000	60,000	13,069	28'	34' 6"	10' 10"	First to exceed Mach 1, 10-14-47.
	X-1A[1]	1	1 RMI XLR-11-RM-5 @ 6,000 lb. t.	1,650	70,000	16,000	28'	35' 7"	10' 9"	Turbine driven fuel pump.
	X-2	1	1 C-W Rocket	2,250	100,000	.....	.....	.....	.. ....	Stainless-steel swept wings, K-Monel fuselage, tail.
	X-5	1	1 All. J35-A-17 @ 4,900 lb. t.	.....	.....	9,900	32' 9"[2]	33' 6"	12' 2"	Variable-sweep wings. Transonic trials.
Consolidated Vultee Aircraft Corp. *San Diego, Calif.*	XF-92A	1	1 All. J33-A-29 @ 5,200 lb. t.+	.....	.....	15,000	31' 3"	42' 5"	17' 8"	Delta-wing research.
Douglas Aircraft Co. *El Segundo, Calif.*	D-558-I	1	1 All. J35-A-11 @ 5,000* lb. t.	650+	.....	10,000*	25	35' 1"	12' 2"	Set record of 650.6 mph. 8-25-47.
	D-558-II	1	1 RMI Rocket[3] @ 6,000 lb. t.	1,238[4]	.....	.....	25'	45' 3"	11' 6"	Wings swept 35 deg.
	X-3	1	2 West. J34-WE-17 @ 4,500 lb. t.[5]	.....	.....	27,000	22' 8"	66' 9"	.....	High-speed, altitude research.
Northrop Aircraft, Inc. *Hawthorne, Calif.*	X-4	1	2 West. J30 @ 1,600 lb. t.	.....	10,000	7,000*	26' 10"	23' 4"	14' 10"	Semi-tailless sweptwing. High-transonic tests.

* — Approximate
All. — Allison
C-W — Curtiss-Wright
RMI — Reaction Motors, Inc.
West. — Westinghouse
Lb. t. — Pounds thrust

[1] Other versions: X-1B, X-1D. Each will collect specific data in supersonic regime. X-1D destroyed during test program 8-23-51.

[2] Wings fully forward. With wings swept, span is 23 ft. 4 in.

[3] Originally fitted also with one Westinghouse J34 to provide takeoff power and climb to altitude. Turbojet later removed from at least one of three Skyrockets to make room for more rocket fuel. Plane then carried aloft in belly of Boeing P2B-1S Superfortress.

[4] This speed achieved during course of high-speed, high-altitude trials.

[5] Originally 2 Westinghouse J46 jets of approximately 7,000 lb. thrust each scheduled for X-3.

U. S. Military Aircraft

Manufacturer and Address	Designation Model	Designation Name	Primary Mission	Number of crew	Powerplants: Number, make, model and max. takeoff power of engine	Max. speed (mph.)	Weight: Gross weight (lb.)	Dimensions: Overall span	Dimensions: Overall length	Dimensions: Overall height	Dimensions: Wing area (sq. ft.) including ailerons	Basic Ordnance
Beech Aircraft Corp. *Wichita 1, Kan.*	T-34A	Mentor	Trainer	2	1 Con. O470-13 @ 225 hp.	189	2,900	32′ 11″	25′ 10″	9′ 7″	177.6	None
Boeing Airplane Co. *Seattle 14, Wash.*	B-47E[2]	Stratojet	Med. Bomb.	3	6 GE J47 @ 5,800 lb.t.	600*	185,000	116′	106′ 8″	27′ 11″	.....	2 x 20-mm.
	B-52A	Stratofortress	Heavy Bomb.	....	8 P&W J57-P-3 @ 10,000 lb.t.	600+	350,000+	185′	153′	48′	.....	Classified
Cessna Aircraft Co. *Wichita, Kan.*	L-19A	Bird Dog	Liaison	2	1 Co. O470-11 @ 213 hp.	155	2,100	36′	25′	7′ 6″	174	None
	XT-37	.....	Trainer	2	2 Con. Marbore 352 @ 900 lb.t.	400*	5,600*	33′	27′ 1″	9′ 10″	.....	None
Consolidated Vultee Aircraft Corp. *San Diego, Calif.* *Ft. Worth, Tex.*	B-36J	.....	Heavy Bomb.	16	6 P&W R4360-53 @ 3,800 hp.[3]	435+	400,000+	230′	162′	46′ 9″	4,772	16 x 20-mm.
	F-102[2]	.....	Fighter	1	1 P&W J57-P-11 @ 10,000 lb. .	750+	.....	.....	.....	.....	.....	Missiles
	T-29D	.....	Trainer	4	2 P&W R2800-99W @ 2,500 hp.	301	40,000+	91′ 9″	74′ 8″	27′ 3″	817	None
	XF2Y-1	Sea Dart	Fighter	1	2 West. J34 @ 3,500 lb.t.	700*	.....	.....	.....	.....	.....	Classified
	R3Y-1	Tradewind	Transport	11	4 All. T40 @ 5,500 eshp.	350+	160,000+	145′	142′ 6″	51′ 5″	.....	.....
Douglas Aircraft Co., Inc. *El Segundo, Calif.* *Long Beach, Calif.*	B-66B	.....	Attack	3	2 All. J71-A-9 @ 10,000 lb.t.	600+	.....	.....	.....	.....	.....	Classified
	AD-6	Skyraider	Attack	1-3	1 Wr. R3350-26WA @ 2,700 hp.	300+	18,000	50′	38′ 10½″	15′ 8″	400	2 x 20-mm.
	A3D-1	.....	Attack	3	2 P&W J57 @ 10,000 lb.t.	650+	70,000*	.....	.....	.....	.....	Classified
	XA4D-1	.....	Attack	....	Wr. J65	.....	.....	.....	.....	.....	.....	Classified
	F4D-1[4]	Skyray	Fighter	1	1 P&W J57 @ 15,000 lb.t.	750+	.....	33′ 6″	50′*	.....	.....	Classified
Fletcher Aviation Corp. *Pasadena, Calif.*	FD-25B	Defender	Attack	1	1 Con. E225-4 @ 250 hp.	187	2,500	30′	20′ 11″	6′ 3″	150	2 x .30-cal.
Grumman Aircraft Engineering Corp. *Bethpage, L.I., N. Y.*	SA-16A	Albatross	Rescue	4-6	2 Wr.R1820-76 @ 1,425 hp.	247	34,000	80′	60′ 8″	24′ 3″	833	None
	F9F-6[5]	Cougar	Fighter	1	1 P&W J48 @ 7,000 lb t.*	650+	.....	.....	.....	.....	.....	Classified
	S2F-1	.....	ASW	4	2 Wr. R1820-76 @ 1,450 hp.	.....	.....	.....	.....	.....	.....	Classified
Lockheed Aircraft Corp. *Burbank, Calif.*	F-94C	Starfire	AW Fighter	2	1 P&W J48-P-5 @ 6,250 lb.t.+	600+	20,000*	37′ 6″	41′ 5″	13′ 7″	.....	48 x 2.75-in. rockets
	XF-104	.....	Fighter	1	1 Turbojet	.....	.....	.....	.....	.....	.....	.....
	T-33A	.....	Trainer	2	1 All. J33-A-35 @ 5,200 lb.t.+	600*	15,000	38′ 10½″	37′ 8″	11′ 8″	237.6	2 x .50-cal.
	P2V-7	Neptune	Patrol	8*	2 Wr. R3350 @ 3,700 hp.[6]	3000+	.....	.....	.....	.....	.....	.....
	P2V-6	Neptune	Patrol	....	2 Wr. R3350 @ 3,250 hp.	300*	.....	104′*	79′*	28′	1,000	Classified
	WV-2[7]	.....	Picket	....	4 Wr. R3350-34 @ 3,250 hp.	325*	120,000	123′	116′	25′*	1,650	None
	T-33B[8]	.....	Trainer	2	1 All. J33-A-16A @ 7,200 lb.t.	600*	.....	42′*	38′*	13′*	.....	.....
Glenn L. Martin Co. *Baltimore 3, Md.*	B-57A	.....	Intruder	2	2 Wr. J65 @ 7,200 lb.t.+	600+	50,000+	64′	65′ 6″	15′ 7″	960	Classified
	P5M-2[9]	Marlin	Patrol	7	2 Wr. R3350-32W @ 3,400 hp.	.....	70,000*	118′	99′	31′ 7″	.....	.....
	XP6M-1	Sea Master	Patrol	....	Turbojet	.....	.....	.....	.....	.....	.....	Classified
McDonnell Aircraft Corp. *St. Louis, Mo.*	XF-101	Voodoo	Fighter	1	2 P&W J57-P-13 @ 10,000 lb.t.	760+	.....	.....	.....	.....	.....	Classified
	F3H-1N[10]	Demon	Fighter	1	1 West. J40-WE-8 @ 10,000 lb.t.	750+	.....	35′ 4″	59′*	14′*	.....	4 x 20-mm.
North American Aviation, Inc. *Los Angeles ,Calif.*	F-86D	Sabre	AW Fighter	1	1 GE J47-GE-17 @ 5,800 lb.t.	700	18,000	37′ 1″	40′ 3″	15′	.....	24 x 2.75-in. rockets
	F-86F	Sabre	Fighter	1	1 GE J47-GE-27 @ 5,800 lb.t.+	650+	20,000*	37′ 1″	37′ 5″	14′ 7″	.....	6 x .50-cal.
	F-86H	Sabre	Fighter	1	1 GE J73-GE-3 @ 9,500 lb.t.	650*	19,000	37′	38′	15′	.....	6 x .50-cal.
	F-100A[11]	Super Sabre	Fighter	1	1 P&W J57-P-7 @ 15,000 lb.t.	750+	.....	36′	45′	13′	.....	Rockets
	T-6G	Texan	Trainer	2	1 P&W R1340-AN-1 @ 600 hp.	212	5,280	42′	29′ 6″	11′	258	.....
	T-28B	.....	Trainer	2	1 Wr. R1820 @ 1,425 hp.	343	8,013	40′ 7″	32′	12′ 8″	271	.....
	TF-86F	Sabre	Trainer	2	1 GE J47-GE-27 @ 5,800 lb.t.	650	17,000*	37′	42′	14′	.....	2 x .50-cal.
	AJ-2	Savage	Attack	3	2 P&W R2800-48 hp. @ 2,400[12]	425*	.....	71′	65′	20′	.....	Classified
	FJ-2	Fury	Fighter	1	1 GE J47-GE-2 @ 5,800 lb.t.	650	18,000	47′	37′	14′	.....	4 x 20-mm.
	FJ-3	Fury	Fighter	1	1 Wr. J65 @ 7,200 lb.t.+	700+	.....	.....	.....	.....	.....	4 x 20-mm.
	FJ-4	Fury	Fighter	1	1 Wr. J65 @ 7,220 lb.t.	700*	.....	.....	.....	.....	.....	4 x 20-mm.
Northrop Aircraft, Inc. *Hawthorne, Calif.*	F-89D	Scorpion	AW Fighter	2	2 All. J35 @ 5,200 lb.t.+	600*	40,000*	56′ 2″	53′ 4″	17′ 7″	600*	104 2.75-in. rockets
Republic Aviation Corp. *Farmingdale, L.I., N. Y.*	F-84F[13]	Thunderstreak	Fighter	1	1 Wr. J65 @ 7,200 lb.t.+	600+	25,000	34′	43′	14′	.....	6 x .50-cal.
	XF-91	.....	Fighter	1	1 GE J47-GE-3 @ 5,200 lb.t.*[13]	700+	.....	31′	46′ 8″	18′	.....	Classified
	XF-103	.....	Fighter	1	1 Wr. J67 @ 15,000 lb.t.	750+	.....	.....	.....	.....	.....	Classified
	XF-105	.....	Fighter	1	All. J71-A-7 @ 10,000 lb.t.	650+	.....	.....	.....	.....	.....	Classified
Ryan Aeronautical Co. *San Diego, Calif.*	72	.....	Trainer	2	1 Lyc. GO435-C2 @ 260 hp.	175	2,900	37′ 8″	28′ 4″	7′ 11″	196.2	.....
Temco Aircraft Corp. *Dallas 2, Tex.*	33	Plebe	Trainer	2	1 Con. O470-13 @ 225 hp.	192	2,500	31′ 2½″	24′ 5″	9′ 10″	154	.....
Chance Vought Aircraft, Inc. *Dallas, Tex.*	F7U-3	Cutlass	Fighter	1	2 West. J46 @ 6,000 lb.t.	700+	.....	.....	.....	.....	.....	Classified
	A2U-1	Cutlass	Attack	1	2 West. J46 @ 6,000 lb.t.	650+	.....	.....	.....	.....	.....	.....
	F8U-1	.....	Fighter	1	1 P&W J57 (afterburner)	.....	.....	.....	.....	.....	.....	.....

* — Approximate.
All. — Allison.
AW — All-weather.
Con. — Continental.
Fr. — Franklin (Aircooled Motors).
GE — General Electric.
P&W — Pratt & Whitney Aircraft.
West. — Westinghouse.
Wr. — Wright.

[1] Plus four GE J47 turbojets of approximately 5,200 lb. thrust each paired in underwing pods.
[2] Reconnaissance version is RB-47E. Stratojets are also built by Douglas Aircraft Co., Tulsa, Okla., Lockheed Aircraft Corp., Marietta, Ga.
[3] Later model will have new wing and more powerful Wright J67 turbojet.
[4] Douglas XF4D-1 with Westinghouse J40 set 3-km. speed record of 753.4 mph. October 1953.
[5] F9F-7 is similar but has Allison J33-A-16.
[6] Plus 1 Westinghouse J34 @ 3,400 lb. thrust under each wing.
[7] USAF counterpart is RC-121C.
[8] Similar to T-33A but with automatic wing slats, new new cockpit, tail. Has tail-mounted drag chute. Developed with Lockheed funds.
[9] Similar to P5M-1 but with T-tail and low chine bow.
[10] Later F3H production models powered with Allison J71.
[11] Set 15-km. speed record of 754.98 mph. November 1953.
[12] Fighter versions have nose intake. Photo RF-84F carries cameras in "solid" nose and has jet intakes in wing roots. Ordnance: 4 x .50-cal. guns. Thunderstreak range can be extended by air-to-air fueling or using parasite technique with Convair B-36 as "mother".
[13] Plus Reaction Motors XLR-11-RM-9 rocket motor unit of approximately 6,000 lb. thrust in tail.
[14] Plus one Allison J33 in rear fuselage.

The Problem: Serious friction problems were preventing the acceptance of a unit manufactured by a nationally known producer of aircraft equipment. Electrofilming, chrome plating and other excellent surface treatments were tested without success. The treatments that reduced friction appreciably failed to meet the corrosion specification. Those that provided the required corrosion resistance failed to reduce friction within the required limits.

How it was solved: Following a meeting held with the engineers responsible for the project, ELECTROLIZED parts were tested. Friction was reduced by 50% and the 100-hour salt spray requirement was met. Repetitive tests established the consistency of ELECTROLIZING to the satisfaction of the authority responsible for the acceptance of the unit. ELECTROLIZING was incorporated in the drawing.

What it means to you: If you are searching for an answer to friction, wear, abrasion, or corrosion problems, ELECTROLIZING is the ideal starting point.

At no cost and without sacrificing project time, you can quickly appraise this process in terms of your own needs. Our 16-page booklet will help you. It describes some of the difficult engineering problems that have been solved with ELECTROLIZING. Just return the coupon for your copy. There is no obligation.

THE Electrolizing CORPORATION
1505 EAST END AVENUE, CHICAGO HEIGHTS, ILLINOIS
Plants:
Providence 1, R.I. 148 W. River St. | Cleveland 10, Ohio 1650 Collamer Rd. | Chicago Heights, Illinois 1505 East End Ave. | Los Angeles, Calif., 1406 East 15th St.

THE ELECTROLIZING CORPORATION
1505 East End Avenue
Chicago Heights, Illinois

Please send me the 16-page Electrolizing booklet:

Name .....
(Please Print)
Company .....
Address .....
City ..... *State* .....

U. S. Personal and Business Aircraft

Manufacturer and Address	Designation	Seats	Powerplants: Number, make, model and max. takeoff power of engine	Performance: Maximum speed @ gross wt. (mph.)	Performance: Cruise speed (mph.)	Performance: Takeoff distance (ft.) to clear 50-ft. obstacle @ gross wt., no wind @ SL	Performance: Landing distance (ft.) over 50-ft. obstacle @ gross wt., no wind @ SL	Performance: Initial rate of climb (fpm.) @ gross wt. @ SL	Performance: Service ceiling (ft.) @ gross wt.	Performance: Max. still air range (mi.) @ gross weight, without auxiliary fuel	Fuel: Normal fuel capacity (gal.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Dimensions: Overall span	Dimensions: Overall length	Dimensions: Overall height	Dimensions: Wing area including ailerons (sq. ft.)	Price: Standard model price (FAF)
Aerocar, Inc. *Langview, Wash.*	1 (Flying Auto)	2	1 Lyc. O290-D2 @ 135 hp.	120+	100+	1,225*	750*	500+	12,000	350	24	1,950	1,400	31' 4½"	21' 2"	7' 2"	190	$25,000
Aero Design & Engineering Corp. *Bethany, Okla.*	Aero Commander 520	5-7	2 Lyc. GO425-C2B @ 260 hp.	211	197	950	900	1,700	21,000	1,150	150	5,500	3,800	44'	34' 2½"	14' 1½"	242.5	$66,000
Aero-Flight Aircraft Corp. *Long Beach, Calif.*	Streak 165	2	1 Fr. @ 165 hp.	219	210	429	.....	2,000	25,500	1,060	40	1,695	1,045	25' 3"	22' 4"	8' 3"	.....	.....
Anderson, Greenwood & Co. *Bellaire, Tex.*	AG-14	2	1 Con. C90-12FP @ 90 hp	120+	110	.....	.....	700+	19,000+	450	23	1,100	850	34'	22'	8'	120	$4,495
Baumann Aircraft Corp. *Pacoima, Calif.*	Brigadier B-290	5	2 Con. C145 @ 145 hp	190	170	1,500*	800*	1,250*	18,000	750	75*	3,500*	2,250*	41'	27' 5"	10'*	213	.....
Beech Aircraft Corp. *Wichita, Kan.*	D18S Twin Beech E18S Twin Beech	8	2 P&W R985-B5 @ 450 hp. 2 P&W R985-AN-14B @ 450 hp.	230 234	211	1,760 2,080	1,460 1,570	1,190 1,250	20,500 23,000	985 1,455	206	8,750 9,300	5,770 6,150	47' 8"	34' 3"	11' 8"	349	$87,050 $100,000*
	E35 Bonanza[1]	4	1 Con. E225-8 @ 225 hp.	194	184	1,009	707	1,300	19,000	830	39	2,725	1,675	32' 10"	25' 2"	9' 6½"	177.6	$19,990
	B50 Twin Bonanza	6	2 Lyc. GO435-C2 @ 260 hp.	205	185	1,258	1,375	1,450	20,000	1,088	134	5,000	3,940	45' 3½"	31' 7"	11' 4"	277	$69,950
Beecraft Associates, Inc. *San Diego, Calif.*	Wee Bee	1	1 Kiek. O43-35 @ 28 hp.	82	72	700	500	350	9,000	75	5	410	210	18'	14' 2"	5'	44	.....
	Honey Bee	1	1 Con. A65-8 @ 65 hp.	120	110	500	400	1,000	18,000	240	9	860	610	28'	16' 10"	7' 8"	96	.....
	Queen Bee	4	1 Lyc. O320 @ 150 hp.	175	160	1,000	700	1,000	16,000	700	36	2,150	1,190	32' 10"	22' 1"	8' 5"	130	.....
Bellanca Aircraft Corp. *New Castle, Del.*	14-19 Cruisemaster	4	1 Lyc. O435-A @ 190 hp.	....	180	.....	.....	1,400	22,500	900	54	2,600	1,560	34' 2"	23'	9' 2½"	161.5	.....
Callair *Afton, Wy.*	A-2	2-3	1 Lyc. O290-D2 @ 140 hp.	120	105	.....	.....	1,000	17,500	656	25	1,550	975	35' 9½"	23' 5½"	7'	181.6	$6,425[2]
	S-1B1 Super Cadet	2	1 Lyc. O290-D2 @ 135 hp.	125	115	.....	.....	1,200	17,500	600	40	1,650	1,000	35' 6"	24'	7'	.....	$5,320
Central Lamson Corp. *Seattle, Wash.*	Air Tractor L-101	1	1 P&W R985 @ 450 hp.	120	105	1,130	1,000	510	.....	320	50	5,500	2,955	32' 7"	28'	11' 6"	350	.....
Cessna Aircraft Co. *Wichita, Kan.*	170	4	1 Con. C145 @ 145 hp.	140	120	.....	.....	690	15,500	540	42	2,200	1,205	36'	25'	6' 7"	175	$8,295
	180	4	1 Con. O470-A @ 225 hp.	165	150	.....	.....	1,150	19,800	675	60	2,550	1,460	36'	26'	7' 6"	175	$12,950
	195 LC-126A	5	1 Jacobs R755 @ 300 hp.	180	165	.....	.....	1,200	18,300	750	80	3,350	2,030	36' 2"	27' 4"	7' 2"	218	$24,700
	310	5	2 Con. O470-B @ 240 hp.	220	205	.....	.....	1,700	20,000	1,000	100	4,600	2,850	36' 1"	27' 1"	10' 2"	175	$19,950
Colonial Aircraft Corp. *Huntington, L. I., N. Y.*	C-1 Skimmer	2-3	1 Lyc. O290-D @ 130 hp.	125	115	.....	.....	700	.....	700	40	1,950	1,300	34'	23' 6"	8' 10"	150.6	$12,500
Helio Aircraft Corp. *Norwood, Mass.*	H-391 Courier YL-24	4	1 Lyc. GO435-C2B @ 260 hp.	....	157	500[4]	500	1,100	27,000	600	60	2,800	1,900	39'	30'	8' 9½"	231	$24,500
Lanier Aircraft Corp. *Marlton, N. J.*	Paraplane 2	2	1 Con. C90 @ 90 hp.	124	108	300*	250*	1,225	.....	.....	.....	.....	.....	20' 5"	22'	6' 4"	107	.....
Meyers Aircraft Co. *Tecumseh, Mich.*	145	2	1 Con. C145-2H @ 145 hp.	166	160	600	575	960	18,000	600	32	1,910	1,250	30'	21' 10"	6'	155	$9,750
	300	4	1 Con. O470-E @ 225 hp.	196	182	.....	.....	1,050	18,000	700	44	2,600	1,625	39' 4"	23' 8½"	8'	160	$16,000
Mooney Aircraft, Inc. *Kerrville, Tex.*	18LA Mite	1	1 Lyc. O145-B2 @ 65 hp.	140*	125	.....	.....	1,090	19,400	.....	11	780	520	26' 10½"	17' 7"	6' 2½"	95	.....
	20	4	2 Con. C145-2H @ 145 hp.	176	161	.....	.....	1,260	21,900	718	.....	2,000	1,049	35'	23' 2½"	8' 3½"	166.9	.....
Piper Aircraft Corp. *Lock Haven, Pa.*	PA-18 Super Cub	2	1 Lyc. O290-D2 @ 135 hp.	127	112	500	600	1,050	20,500	500	36	1,500	895	35' 3"	22' 5"	6' 7"	178.5	$5,095
	PA-18 95 Super Cub	2	1 Con. C90 @ 90 hp.	110	100	952	800	624	13,500	360	18	1,500	800	35' 3"	22' 4"	6' 7"	178.5	$4,195
	PA-18-A 135	1-2	1 Lyc. O290-D2 @ 135 hp.	135	110	210	600	1,000	19,500	500	36	1,500	930	35' 3"	22' 4"	6' 7"	178.5	$5,195
	PA-20 Pacer	4	1 Lyc. O290-D2 @ 135 hp.	139	125	.....	.....	800	15,000	580	36	1,950	1,050	29' 3"	20' 4"	6' 7"	147.5	$6,275
	PA-22 Tri-Pacer	4	1 Lyc. O290-D2 @ 135 hp.	137	123	.....	.....	800	15,000	580	36	1,950	1,085	29' 3"	20' 4"	8' 4"	147.5	$6,475
	PA-23 Apache	4	2 Lyc. O320 @ 150 hp.	180	167	900	670	1,350	20,000	850	72	3,500	2,168	37'	27' 2"	9' 6"	204.2	$32,500
Rawdon Bros. Aircraft, Inc. *Wichita, Kan.*	T-1	2	1 Lyc. O320 @ 150 hp.	140	130	600	600	900	19,000	600	44	1,900	1,275	33' 4"	24' 6"	7' 3"	167	.....
Stits Aircraft *P. O. Box 3084* *Riverside, Calif.*	Junior	1	1 Con. C85 @ 87 hp.	185	165	800	1,000	1,000	.....	75	4½	584	393	8' 10"	11' 4"	4' 2"	38	.....
	Skybaby	1	1 Con. C85 @ 112 hp.	215	185	800	800	1,600	.....	100	5	660	452	7' 2"	9' 10"	5'	36.5	.....
	Pla boy SA3A[5]	1	1 Con. C85-8 @ 87 hp.	170	155	350	600	1,600	14,000	450	16	.....	540	20' 6"	17' 4"	5' 3"	90	$2,500
Streak Aero Corp. *P. O. Box 181* *Hollydale, Calif.*	Stre -225[5]	2	1 Lyc. @ 225 hp.	238	225	490	.....	2,810	27,000	1,350	60	1,964	1,170	25' 3"	22' 6"	8' 1"	.....	.....
Taylorcraft, Inc. *Conway, Pa.*	BC-12-D De Luxe	2	1 Con. C65 @ 65 hp.	105	95	350	710	600	15,000	450	25	1,200	780	36' 4"	21' 9"	6' 6"	183.7	$3,060
	15AG Topper	1	1 Con. @ 225 hp.	131	122	1,250	560	925	17,300	400	42	3,015	1,505	36' 5"	24'	7' 1½"	186.3	$8,950
Temco Aircraft Corp. *Dallas, Tex.*	Twin Navion[6]	4	2 Lyc. O320 @ 150 hp.	180	170	700	650	1,400	20,000	600	60	3,350	2,300	33' 4½"	27' 2"	9' 6½"	178.3	$28,500[6]

* — Approximate.
Con. — Continental
Fr. — Franklin (Aircooled Motors).
Hp. — Horsepower.
Kiek. — Kiekhaefer.
Lyc. — Lycoming.

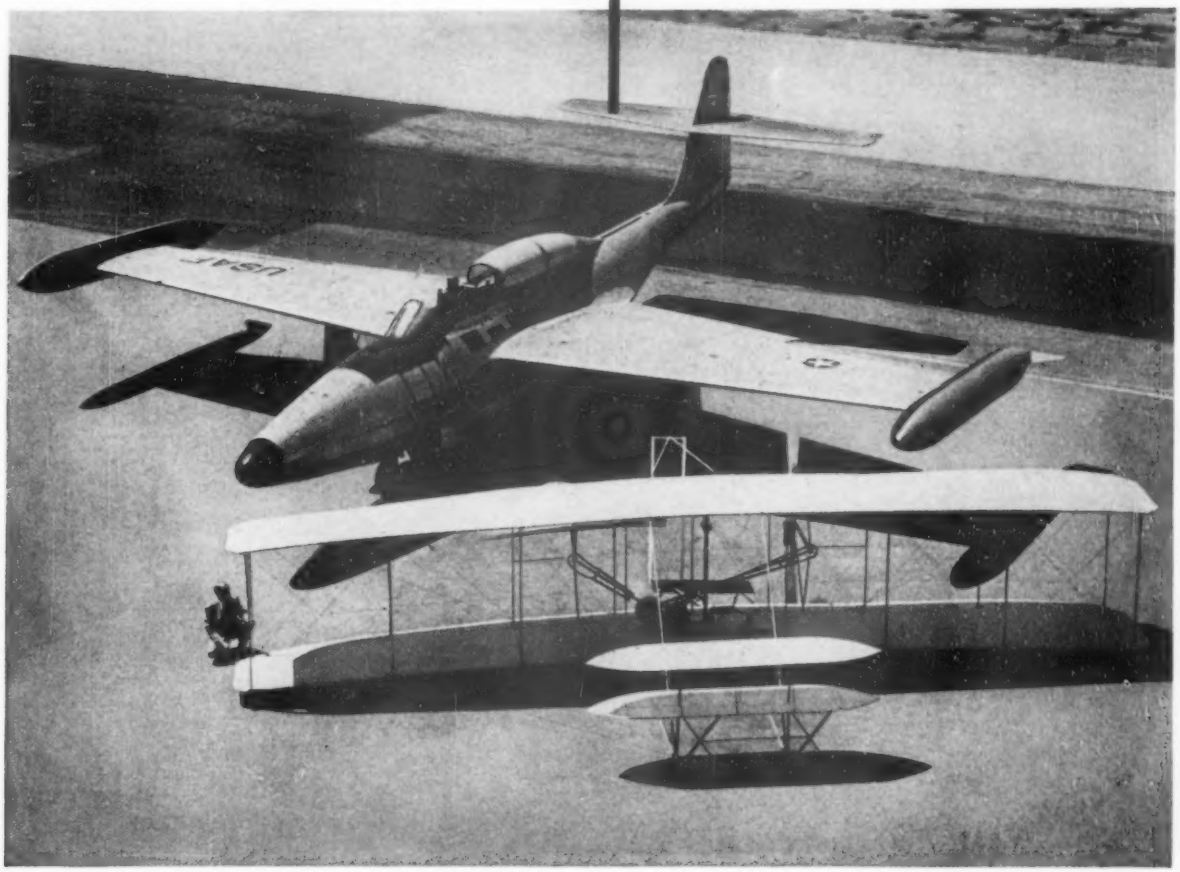
P&W — Pratt & Whitney Aircraft.
SL — Sea Level.

[1] Also available with Con. E185-11 @ 205 hp. This version costs $18,990.
[2] De luxe model.
[3] All fuel in tiptanks.
[4] Experimental model which is being developed to two-placer with folding wings.
[5] Built under license from Aero-Flight Aircraft Corp. maker of Streak 165.
[6] Plus original Ryan or North American-built single-engine airframe.

Western Gear

EQUIPPED!

The Northrop F-89 as well as the replica of the Wright Brothers first airplane are both Western Gear equipped



Whatever your aircraft mechanical power transmission problem may be, the "right" design in finished product is assured you when you draw on Western Gear's many years of experience. The aviation industry has depended upon Western Gear's engineers for the solution of their gear design problems for over three decades.

There is scarcely a military and commercial plane in use today – or on the drawing board for tomorrow – that doesn't use one or more Western Gear drives. Why not call us next time?

WRITE–For further information and a copy of "Gearing for the Age of Flight." Write on company letterhead to the Executive Offices, Western Gear Works, P.O. Box 182, Lynwood, California.

SINCE 1888

WESTERN GEAR WORKS

PACIFIC-WESTERN PRODUCTS | POWER TRANSMISSION GEARS • MACHINERY •

PACIFIC GEAR & TOOL WORKS · SOUTH WESTERN GEAR WORKS

PLANTS AT LYNWOOD, PASADENA, BELMONT, SAN FRANCISCO (CALIF.), SEATTLE AND HOUSTON – REPRESENTATIVES IN PRINCIPAL CITIES

U. S. Civil and Military Transport Aircraft

Manufacturer and Address	Designation	Seats: Crew	Seats: Passengers	Power Plants: Number, make, model and max. takeoff power of engine	Performance: Max. speed (mph.)	Performance: Cruise speed (mph.)	Performance: Takeoff distance (ft.) over 50 ft. obstacle, @ gross wt., no wind @ SL	Performance: Landing distance (ft.) over 50 ft. obstacle @ max. allowable landing gross wt. no wind @ SL	Performance: Initial rate of climb (fpm.) @ max. gross wt. @ SL	Performance: Max. still air range (mi.)	Fuel: Normal fuel capacity (gal.)	Weights: Max. gross weight (lb.)	Weights: Empty weight (lb.)	Dimensions: Overall span	Dimensions: Overall length	Dimensions: Maximum height	Dimensions: Wing area including ailerons (sq. ft.)
Boeing Airplane Co.	707[1]	.....	100	4 P&W J57 @ 11,000 lb. thrust*	600+	580	.....	.....	.....	.....	.....	190,000	92,120	130′	127′ 10″	38′ 3″	2,400
Seattle 14, Wash.	KC-97G Stratofreighter	5	96	4 P&W R4360-59 @ 3,500 hp.	375	300	5,500	4,000	.....	4,300	7,790	175,000	.....	141′ 3″	110′ 4″	38′ 3″	1,769
Consolidated Vultee Aircraft Corp.	340 Convair-Liner	3–4	44	2P&W R2800-CB-16 @ 2,400 hp.	314	284	4,675	4,500	1,220	1,260	1,750	47,000	29,486	105′ 8″	79′ 2″	28′ 2″	920
	.....Turbo-Liner	.....	.....	2 All. T-501 @ 2,750 eshp.	350+	310	2,150	.....	1,940	1,550	1,550	41,800*	.....	91′ 9″	74′ 8″	27′*	817
San Diego, Calif.	C-131A Samaritan	4	.....	2 P&W R2800-99 @ 2,500 hp.	320	.....	.....	.....	.....	.....	1,550	40,000+	28,300	91′ 9″	74′ 8″	27′ 3″	817
Douglas Aircraft Co., Inc.	DC-6A Liftmaster	3	0	4 P&W R2800-CB-17 @ 2,500 hp.	371	315	4,500	3,100	1,000	3,400	3,992	107,000	51,316	117′ 6″	106′ 6″	28′ 8½″	1,463
	DC-6B	5	66	4 P&W R2800-CB-16 @ 2,400 hp.	371	315	5,680	4,995	1,030	3,720	3,992	100,000	55,357	117′ 6″	106′ 6″	28′ 8″	1,463
Santa Monica, Calif.	DC-6B	7	54–89	4 P&W R2800-CB-17 @ 2,500 hp.	370	315	5,910	5,160	1,000	4,970	5,512	107,000	58,340	117′ 6″	106′ 6″	28′ 8″	1,463
	DC-7	5	60–90	4 Wr. 972TC18DA4 @ 3,250 hp.	406	360	6,350	5,870	1,130	4,933	6,260	125,000	68,073	117′ 6″	108′ 11″	28′ 7″	1,463
	C-124C Globemaster 2	8	200	4 P&W R4360-63A @ 3,800 hp.	.....	.....	.....	.....	.....	.....	11,058	185,000	101,052	174′ 1″	130′	48′ 3″	2,510
	R4D-8	3	35	2 Wr. R1820-80 @ 1,475 hp.	270	238	2,330	1,560	1,350	4,700	1,604	31,000	19,500	90′	67′ 8½″	18′ 3″	967
Fairchild Aircraft Div.	M-186B	2–4	44	2 Wr. TJ32C3 @ 12,000 lb.t.	.....	570	.....	.....	.....	1,500	.....	75,770	.....	100′	98′ 7″	31′	2,000
Fairchild Engine & Airplane Corp.	C-119G Packet	5	62	2 Wr. R3350-85 @ 3,500 hp.	250+	200	.....	.....	.....	2,200	2,700*	74,400	.....	109′ 3″	86′ 6″	26′ 8″	.....
	C-119H Packet	5	62	2 Wr. R3350-85 @ 3,500 hp.	250+	188	.....	.....	.....	2,250	2,624*	85,900	.....	148′	95′ 8″	32′	.....
Hagerstown, Md.	XC-120 Pack Plane	5	62	2 P&W R4360 @ 3,500 hp.	250+	170	.....	.....	.....	2,100	2,798	70,700	.....	109′ 3″	83′	24′ 10″	.....
	C-123B[2]	2	60+	2 P&W R2800-99W @ 2,500 hp.	245	205	2,250	1,050	1,320	2,050	1,462	54,000	30,000	110′	75′ 9″	34′ 1″	1,223
Lockheed Aircraft Corp.	1049C Super Constellation	5–11	47–99	4 Wr. 972TC18DA1 @ 3,250 hp.	352	331	4,300	3,410	1,195	4,890	6,550	130,000	69,792	123′	113′ 7″	24′ 9″	1,650
Burbank, Calif.	1049D Super Constellation	3–7	0	4 Wr. 972TC18DA1 @ 3,250 hp.	376	333	4,600	.....	.....	4,820	6,550	133,000	.....	123′	113′ 7″	24′ 6″	1,650
	1049E Super Constellation	5–11	47–99	4 Wr. 972TC18DA1 @ 3,250 hp.	376	333	4,600	3,550	1,140	4,820	6,550	133,000	70,000	123′	113′ 7″	21′ 9″	1,650
	C-130A	.....	.....	4 All T56 @ 3,750 eshp.*	.....	.....	.....	.....	.....	.....	.....	.....	.....	132′	95′	38′	.....
	R7V-1[3] RC-121C	8	106	4 Wr. R3350-34 @ 3,250 hp.	400*	340	4,300*	3,400*	1,200*	.....	.....	130,000	.....	123′	116′ 2″	24′ 8″	1,654
Glenn L. Martin Co.	4-0-4	3	40	2 P&W R2800-CB-16 @ 2,400 hp.	312	280	1,980	1,750	1,905	2,525	1,350	44,900	29,126	93′ 3″	74′ 7″	28′ 5½″	864
Baltimore, Md.																	

* — Approximate.
All. — Allison.
P&W — Pratt & Whitney Aircraft.
Wr. — Wright.
Eshp. — Equivalent shaft horsepower.
Hp. — Horsepower.
Lb.t. — Pounds thrust.
[1] Estimated data.
[2] Former Chase Aircraft Co. airplane to be produced by Fairchild.
[3] R7V-2 will have P&W T34 turboprops.

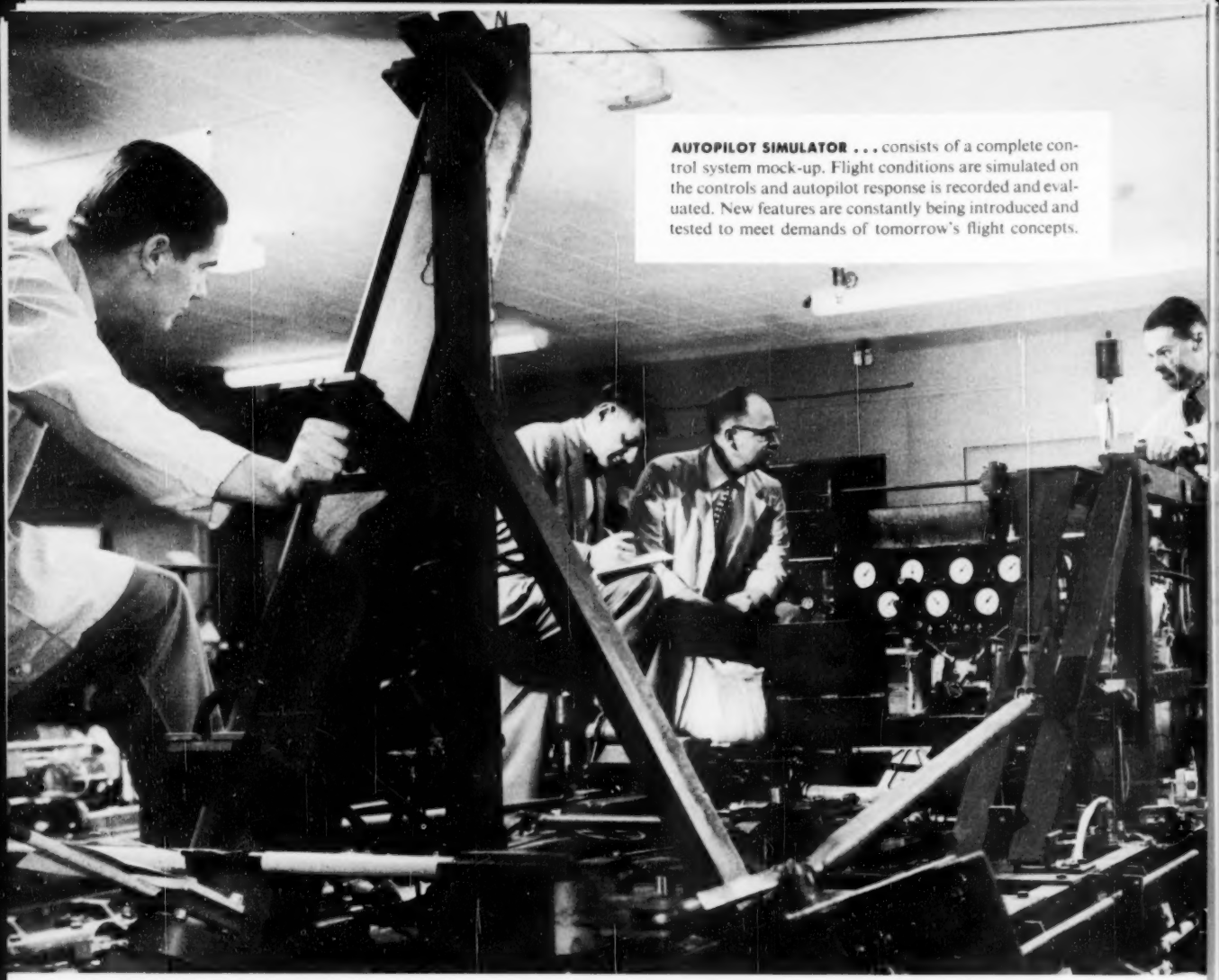
PIPE CAP
PIPE PLUG
AN TYPE BOSS
(for flush threaded openings.)
AN TYPE SEAL PLUG
FITTINGS ER-A AIRCRAFT TYPE
PLUG FOR WEATHERHEAD
AN TYPE SEAL CAP
AN TYPE ALUMINUM
SHIPPER PLUG
AN TYPE ALUMINUM
SHIPPER CAP
CATALOG
free when requested on your firm letterhead.
KEEP 'EM CLIMBING!
With HAZARD-FREE METAL CLOSURES
THINK OF THE GROUND-WORK . . . in Manufacture or Maintenance you gotta keep 'em alive and climbing.
From the smallest Aircraft to the largest Transport, hydraulic systems are vital! . . . Protect threads, seal out dirt, dust and moisture during Shipping, Storage and Assembly.
Keep 'Em Climbing . . . Keep 'Em Hazard-Free! . . . Use the Accepted Metal Closures that have been the Standard of the Industry for years. Metal Closures made by Tubing Seal Cap, Inc. can't clog vital hydraulic lines . . . can't be "sucked in."
For dependable Aircraft, use these dependable Metal Closures by Tubing Seal Cap, Inc.
★
THE ORIGINAL METAL CLOSURES
by TUBING SEAL CAP, INC.
808 WEST SANTA ANITA, SAN GABRIEL, CALIFORNIA
EASTERN OFFICE: 428 NEW CENTER BLDG., DETROIT 2, MICHIGAN

The rate automatic pilot . . . only system to give unlimited maneuverability, precise control at high speeds

Westinghouse automatic flight control systems represent the most advanced state of the art in the autopilot field. The W-3 and E-9 automatic pilots make completely automatic flight *fact* instead of *fancy*. Developed, flown and now being produced for military jet fighters, they are the first to combine the rate gyroscope and MAGAMPS into a packaged system which is lightweight, compact and completely proved.

The use of the rate gyro makes possible a new degree of precise control and maneuverability not possible with position gyros. MAGAMPS are extensively used to give the rate automatic pilot reliability superior to other types of similar equipment.

FIND OUT WHY . . . ON THE FOLLOWING PAGES ▶

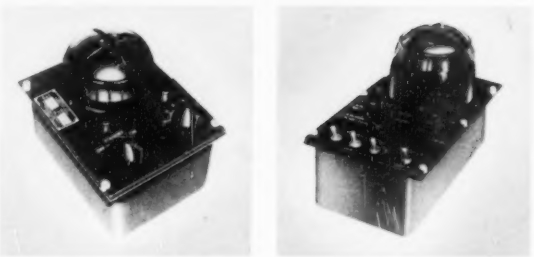


AUTOPILOT SIMULATOR . . . consists of a complete control system mock-up. Flight conditions are simulated on the controls and autopilot response is recorded and evaluated. New features are constantly being introduced and tested to meet demands of tomorrow's flight concepts.

Only production automatic pilot to use rate gyros . . .

Modern, high-speed aircraft, because of aerodynamic requirements, often suffer from poorly damped natural oscillations—they are inherently unstable. The sensing elements which detect these oscillations and provide the "intelligence" to eliminate them is the rate gyroscope. By developing a rate gyro and applying it to the E-9 and W-3 systems, Westinghouse has elevated the automatic pilot to the vitally important tactical role of a completely automatic, integrated flight control system.

The rate gyro will not tumble, and provides instantaneous response to external disturbances and attitude changes. Using rate gyros in all three axes—roll, pitch, and yaw—Westinghouse rate automatic flight control systems can maneuver an aircraft quickly and smoothly, as well as provide "platform" stability.



These are the pilot's consoles of the E-9 and W-3 Rate Automatic Pilots. Controls are human engineered to achieve simplicity of operation. The W-3A has provision for radar coupling and ILS tie-in, making the autopilot serve a vital new role in automatic flight control.

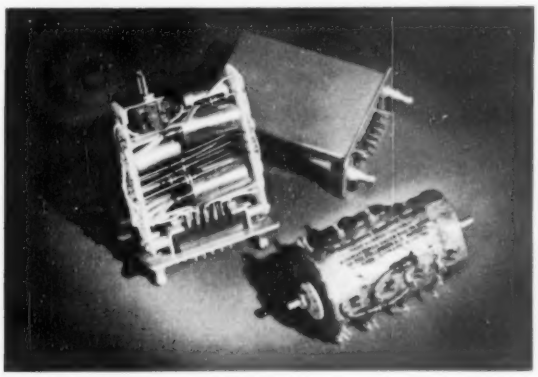
THE SCOPE OF WESTINGHOUSE IN AVIATION

Jet Propulsion • Airborne Electronics • Aircraft Electrical Systems and Motors • Wind Tunnels to Plastics

Magamps improve reliability, decrease weight . . .

The MAGAMP (magnetic amplifier)—a Westinghouse exclusive—is used to make the rate automatic pilot a new standard of dependability. As simple and reliable as iron and copper, MAGAMPS are rugged replacements for vacuum tubes. MAGAMPS operate directly from the ac supply voltage and require no filament current, hence have a greatly reduced cooling requirement. Greater component life is inherent in the transformer-like construction of MAGAMPS. Wherever used, they give systems added value with their reliability and long life.

These features make the Westinghouse rate automatic pilot far more dependable. Maintenance requirements are reduced, circuitry is simplified and these full-time automatic flight control systems can be depended upon to perform under all types of operating conditions.



MAGAMPS and Potted Units are two refinements developed by Air Arm to give electronic systems exceptional reliability and ease of maintenance. MAGAMPS are a Westinghouse development using specially wound cores, printed circuits and Fosterite* impregnation to protect against all atmospheric conditions, and improve heat dissipation and dielectric properties.

• • •

Air Arm facilities now producing rate automatic pilots . . .

Rate automatic pilots are being produced in quantity at the Westinghouse Air Arm Plant. The W-3 system—now flying in an Air Force all-weather interceptor—includes an ILS (instrument landing system) tie-in for automatic, "hands-off" approach to a field in low visibility weather. Soon to come for the W-3 system is a radar tie-in, which means that the automatic pilot will take commands directly from the fire control system and automatically fly the interceptor on a computed intercept course . . . for what might be termed an automatic kill.

Airborne equipment must be as precise as a watch and as rugged as a steam roller. Fabricating such equipment and tailoring it to an airplane is not just a matter of taking measurements and cutting to a pattern—it requires real know-how and experience.

• • •

Today's answer for tomorrow's problem . . .

Experience has shown that in our business no problem ever stays solved. The requirement of building a better system is always with us. To meet the ever-increasing requirements of high-speed automatic flight, our development labs are at work, creating the advancements for tomorrow's flight systems. Thus, Air Arm is helping to bring Tomorrow's Aircraft . . . One Step Closer. Westinghouse Electric Corporation, Air Arm Division, Friendship International Airport, Baltimore, Md. J-91015

Component of Westinghouse Rate-Type Autopilot is shown here being bench tested. This is part of the Air Arm program which guarantees that every unit will meet rigorous military specifications. Ability to produce and qualify complete systems under one roof means more defense for the defense dollar.

YOU CAN BE SURE...IF IT'S

Westinghouse

ENGINEERS...our new brochure tells why

Westinghouse is a career...

The Air Arm Division offers a variety of challenging opportunities, available as a result of our long-range expansion program in the aviation-electronics field.

Many engineers are already building for themselves key positions in the organization that has produced some of the country's most advanced scientific developments. Current openings offer a variety of challenging problems requiring engineers with a high degree of originality and ingenuity. Excellent ground-floor opportunities exist for men from the B.S. to Ph.D. level.

A few of the many exceptional advantages of a career with Westinghouse:

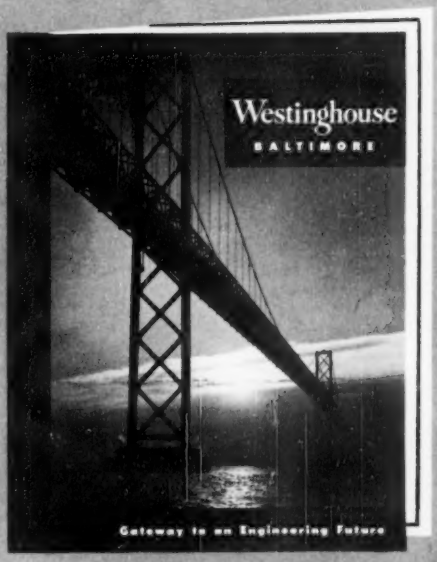
Professional recognition and industrial stability.

Opportunities, at company expense, for advanced degrees.

Exceedingly liberal patent disclosure compensation.

Salaries individually determined according to experience and ability.

Promotion on basis of individual merit.



Send Today for

your copy of "Gateway to an Engineering Future."

Electrical Engineers **Mechanical Engineers**
Physicists **Mathematicians**
Field Service Engineers

YOU CAN BE SURE...IF IT'S

Westinghouse

AIR ARM DIVISION

Mr. R. M. Swisher, Jr.
Employment Supervisor, Dept. A
Westinghouse Electric Corporation
109 West Lombard Street
Baltimore 1, Maryland

Please send me a copy of "Gateway to an Engineering Future."

Name.....

Address.....

City.....State.....

Engineering Field.....

U. S. Civil and Military Helicopters

Manufacturer and Address	Designation		Seats (including crew)	Powerplants: Number, make, model and max. takeoff power of engine	Performance: Maximum speed (mph.) @ SL	Performance: Initial rate of climb (fpm.) @ SL, fully loaded	Performance: Hovering ceiling (ft.) in ground effect	Performance: Normal still air range (mi.)	Fuel: Normal fuel capacity (gal.)	Weights: Max. allowable takeoff gross weight (lb.)	Weights: Empty weight (lb.)	Main Rotor: No. of rotors	Main Rotor: Blades per rotor	Main Rotor: Rotor diameter	Dimensions: Total rotor blade area (sq. ft.)	Dimensions: Max. length (blades unfolded)	Dimensions: Fuselage maximum width	Dimensions: Overall height to top of rotor
American Helicopter Co., Inc. *Manhattan Beach, Calif.*	.....	XH-26	1	2 AHC AJ-6.75* pulsejet	80	.....	.....	1.5 hr.	50	700*	300	1	2	.....	.....	.....	.....	6'
Bell Aircraft Corp. **Helicopter Division** *Ft. Worth, Tex.*	47G	H-13G	3	1 Fr. 6V4-200-C32 @ 200 hp.	90	800	3,600	215	40	2,350	1,409	1	2	35' 1½"	35.3	41' 5½"	7' 6"	9' 5½"
	61	XHSL-1	.....	1 P&W R2800 @ 1,900 hp.	.....	.....	.....	.....	.....	.....	.....	2	2	.....	.....	.....	.....	.....
	200	XV-3[1]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Brantly Helicopter Corp. *C/o Penn Elastic Co.* *Philadelphia, Pa.*	B-2	.....	2	1 Lyc. @ 150 hp.	.....	.....	.....	300+	21	1,250	741	1	3	23'	.....	17' 11"	3' 11"	6' 10"
Cessna Aircraft Co. *Helicopter Division* *Wichita, Kans.*	CH-1	.....	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Convertawings, Inc. *Amityville, N. Y.*	A	Quadrotor	2	2 Con. C90 @ 85 hp.	.....	.....	.....	.....	.....	1,950	.....	4	4	15'	.....	30' 6"	30' 6"	5' 9"
Doman Helicopters, Inc. *Danbury, Conn.*	LZ-5	.....	7	1 Lyc. SO580-D @ 400 hp.	86	500	8,000	.....	50	5,000	2,860	1	4	48'	.....	38'	5'	10' 5"
	.....	YH-31	3	1 Lyc. SO580-D @ 400 hp.	104	1,300	1,300	.....	67	4,419	2,860	1	4	48'	.....	38'	5'	10' 5"
Gyrodyne Co. of America, Inc. *St. James, L.I., N.Y.*	2C	.....	7	1 P&W R985 @ 450 hp.	87	1,030	.....	250	100	5,800	3,800	2	2	48'	102	48'	12' 6"	14' 8"
	3	Helidyne	18	2 P&W R1340 @ 1,200 hp.	150	1,090	.....	350	185	12,800	7,800	2	2	62'	.....	62'	4' 4"	16' 9"
	24	.....	3	2 Turboprop	116	1,000	.....	126	833	70,000	21,629	2	2	110'	.....	110'	.....	.....
	35[1]	.....	76	2 Turboprop	304	2,350	.....	500	.....	83,500	.....	2	4	88'	.....	88'	.....	.....
Hiller Helicopters, Inc. *Palo Alto, Calif.*	UH-12B	H-23B	3	1 Fr. 6V4-200-C33 @ 200 hp.	84	770	3,200	140	28	2,500	1,690	1		35'	32.8	27' 8"	.....	9' 10"
	HJ-1	YH-32	2	2 Hiller ramjet @ 32 lb.t.	76	830	4,000	31	52	1,200	430	1	-	23'	18.2	23'	3' 9"	8'
Jacobs Aircraft Engine Co. *Pottstown, Pa.*	104[1]	.....	5	1 Jacobs R755-EH @ 350 hp.	170	1,400	4,000	260	35	3,627	2,350	1	3	38'	45	26' 4"	14'	10' 10"
Kaman Aircraft Corp. *Windsor Locks, Conn.*	K-240	HTK-1	3	1 Lyc. 0435 @ 240 hp.	.....	1,050	5,700	.....	40	3,100	2,180	2	2	40'	.....	40'	5' 2"	12' 9"
	K-3	HOK-1	4	1 P&W R1340 @ 600 hp.	.....	.....	.....	.....	.....	.....	.....	2	2	47'	.....	47'	5' 4"	10' 2"
	K-5	.....	3	1 Boeing 502-2 @ 190 hp.	.....	.....	.....	.....	.....	.....	.....	2	2	.....	.....	.....	.....	.....
McCulloch Motors Corp. **Aircraft Division** *Los Angeles, Calif.*	MC-4C	YH-30	2	1 Fr. 6A4-200-C6 @ 200 hp.	110	1,000	4,000	200	35	2,300	1,600	2	3	23'	.....	32' 5"	4' 2"	9' 3"
McDonnell Aircraft Corp. *St. Louis, Mo.*	86	XHCH-1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	82	XV-1[1]	4	1 Con. @ 550 hp.	.....	.....	.....	.....	.....	.....	.....	1	3	.....	.....	.....	.....	10'
Piasecki Helicopter Corp. *Morton, Pa.*	.....	YH-16	43	2 P&W R2180-11 @ 1,650 hp.	125+	.....	.....	200	.....	30,000+	.....	2	3	82'	.....	77' 6"	23' 3"	25'
	.....	YH-16A	43	2 All. T38 @ 1,800 hp.	.....	.....	.....	.....	.....	.....	.....	2	3	82'	.....	77' 6"	23' 3"	25'
	PD-22	H-21A	16	1 Wr. R1820-103 @ 1,150 hp.	140+	.....	.....	300	300	14,000+	.....	2	3	44'	.....	52' 6"	14' 2"	16'
	PH-42	H-21B & C	22	1 Wr. R1820-103 @ 1,425 hp.	140+	1,200	5,500	300	300	14,000+	8,600	2	3	44'	.....	52' 6"	14' 2"	16'
	PD-18	H-25A	6	1 Con. R975-46 @ 525 hp.	109	1,000	.....	400*	150	6,100	3,928	2	3	35'	.....	32'	8'	12' 6"
	PD-18	HUP-2	6	1 Con. R975-46 @ 525 hp.	103	1,000	.....	400*	150	6,100	4,132	2	3	35'	.....	32'	8'	13' 2"
Sikorsky Aircraft Division **United Aircraft Corp.** *Bridgeport, Conn.*	S-52	YH-18[1]	4	1 Fr. 6V6-25-B16F @ 245 hp.	111	1,050	2,600	306	60	2,700	1,825	1	3	33'	42.5	.....	5'	8' 8"
	S-55	H-19A	9-12	1 P&W R1340-S1H1 @ 600 hp.	105	1,120	7,900	410	185	6,835	4,785	1	3	53'	70.1	42' 2"	5' 8"	13' 4"
	S-56	XHR2S-1	28*	2 P&W R2800 @ 1,900 hp.	150+	.....	.....	230*	.....	28,500	.....	1	5	.....	.....	.....	.....	.....

* — Approximate.
AHC — American Helicopter Co.
All. — Allison.
Con. — Continental.
Fr — Franklin (Aircooled Motors).
Lyc. — Lycoming.
P&W — Pratt & Whitney Aircraft.
Wr. — Wright.

[1] Convertiplane

USSR Military Aircraft

Category	Designation	No. of crew	Powerplant	Physical Data			Armament	Performance	
			Powerplant no., designation and power, each.	Wingspan, ft.	Overall length, ft.	Gross weight, lb.		Max. speed, mph.	Service ceiling, ft.
FIGHTER	MiG-15/1	1	1 x VK-1 @ 6,000 lb.t.	33.1	36.3	14,223	2 x 23-mm. 1 x 37-mm.	659	49,000
	MiG-15/2	1	1 x VK-1A @ 6,750 lb.t	33.1	36.3	14,238	2 x 23-mm. 1 x 37-mm.	683	51,000
	La-17	1	1 x VK-1 @ 6,000 lb.t.	37.0	40.0	.....	2 x 23-mm.	612	45,000
NIGHTFIGHTER	MiG-17	1	2 x VK-1 @ 6,000 lb t.	33.3	36.7	.....	4 x 23-mm.	685	51,500
	Il-26	3	2 axial @ 5,000 lb.t.	68.0	60.0	.....	4 x 23-mm.	590	45,000
GROUND SUPPORT	Il-10	2	1 x AM42 @ 2,000 hp.	45.5	40.0	.....	2 x 23-mm. 2 x 7.62-mm.	280	27,000
	La-17/2	2	1 x VK-1 @ 6,000 lb.t.	37.0	41.0	.....	4 x 23-mm.	600	40,000
MEDIUM BOMBER	Il-28	3	2 axial @ 5,000 lb.t.	72.0	60.0	.....	4 x 23-mm.	580	45,000
	Il-28/2	3	2 axial @ 5,500 lb.t.	72.0	72.0	.....	6 x 23-mm.	680	45,000
	Tu-12	3	2 axial @ 5,000 lb.t.	70.0	65.0	.....	3 x 23-mm.	580	45,000
	Pe-3	3	2 x VK-105R @ 1,100 hp.	56.1	41.5	16,930	2 x 12.7-mm. 4 x 7.62-mm.	335	29,520
	Tu-2	3	2 x ASH82FNU @ 1,850 hp.	60.9	45.3	28,220	4 x 12.7-mm.	348	36,000
HEAVY BOMBER	Tu-4[1]	6-8	4 radial @ 2,200 hp.	141.0	99.0	.....	.....	225	24,000
	Tu-200	14	6 x turboprop @ 4,850 eshp.	236.0	200	.....	10 x 20-mm. 5 turrets	465	50,000
	Il-38	8	4 x turboprop @ 4,850 eshp.	168.5	132.7	.....	8 x 20-mm. 4 turrets	490	50,000
TRANSPORT	Il-12	2	2 x ASH82 @ 1,700 hp.	100.0	74.3	37,950	None	259	.....
	Il-18	3	4 x ASH82FNU @ 1,850 hp.	110.0	88.0	.....	None	335	.....
	Tu-6(70)	4	4 x radial @2,200 hp.	141.3	119.0	.....	None	215	.....
	Li-2[2]	2	2 x M63 @ 1,000 hp.	95.0	64.5	26,000	None	225	24,000
COMMUNICATION AND LIAISON	Po-2	2	1 x M11 @ 110 hp.	37.5	26.7	1,902	None	90	13,000
	Yak-14	2	1 x M11 @ 145 hp.	39.5	27.7	3,646	None	122	20,000
BASIC TRAINER	Po-2	2	1 x M11 @ 110 hp.	37.5	26.7	1,892	None	93	13,120
	Yak-18	2	1 x M11RF1 @ 160 hp.	34.9	26.3	2,359	None	160	.....
ADVANCED TRAINER	Yak-11	2	1 x ASH21 @ 750 hp.	31.0	28.0	4,880	None	274	.....
	La-7	2	1 x ASH82FNU @ 1,850 hp.	32.2	28.6	.....	None	370	.....
FIGHTER TRAINER	MiG-15	2	1 x VK-1 @ 6,000 lb.t.	33.1	36.3	.....	2 x 23-mm. 1 x 37-mm.	635	47,000
	Yak-15B	2	1 x axial @ 5,000 lb.t.	30.0	28.0	.....	None	506	42,000
BOMBER TRAINER	B-25[3]	4	2 x radial @ 1,700 hp.	67.6	52.0	33,000	None	282	.....
	Il-27	3	2 x axial @ 5,000 lb.t.	68.0	60.0	.....	None	530	45,000
HELICOPTER	Omega III	2	2 x ASH21 @ 750 hp.	.....	.....	.....	.....	.....	.....
	Mil-1	2	.....	.....	.....	.....	.....	.....	.....
FLYING BOAT	MDR-6	3	2 x M62 @ 1,000 hp.	66.0	49.3	.....	4 x7.62-mm.	160	.....
	GSt.[4]	3	2 x M62R @ 1,000 hp.	104.0	62.5	27,080	.....	190	25,200
MISCELLANEOUS, STILL IN SERVICE	Yak-15	1	1 x axial @ 2,450 lb.t.	31.0	29.0	.....	2 x 12.7-mm.	520	43,000
	Yak-9P	1	1 x VK105PF @ 1,120 hp.	32.0	26.3	7,000	1 x 20-mm. 2 x 12.7-mm.	358	.....
	La-11	1	1 x ASH82FNU @ 1850 hp.	31.5	27.8	.....	3 x 20-mm.	402	.....
	Yak-16	2	2 x ASH21 @ 750 hp.	65.0	51.0	14,112	None	193	.....
	UT-2	2	1 x M11 @ 110 hp.	33.5	23.5	2,073	None	124	.....
	Il-4	3	2 x VK105 @ 1120 hp.	.....	.....	.....	3 x 12.7-mm.	.....	.....

Eshp.— Equivalent shaft horsepower.
Hp. — Horsepower.
Lb.t. — Pounds thrust.

[1] Russian-built Boeing B-29.
[2] Lend-lease Douglas C-47.
[3] Lend-lease North American B-25.
[4] Lend-lease Convair PBY.

NOTE: Russian aircraft and engines have been identified either by function or by the last name of the designers.
The former system was used from 1925 to 1940, and some planes (for example the UT-2 trainer-(Uchebny Trenirovochny)-for instructional and training) still retain the old designation.

Since 1940 the practice has been to use the first two or three letters of the designer's last name. These designations appear in the table:

AM — A. A. Mikulin
ASH — A. D. Shvetsov
G — Mikhail Gurevich
Il — Sergei Ilyushin
La — Semyon Lavochkin
M — Motor (old system)
Mi — Artem Mikoyan
Mil — Mikhail Mil
Pe — Vladimir Petlyakov
Po — Nikolai Polikarpov
Tu — Andrei Tupolev
Yak — Alekseandr Yakovlev

This picture of the Convair 340 shows what Rohr is famous for — building power packages — power packages for the Convair 340 — and other world-famous commercial and military planes. Of course, Rohr aircraftsmen do more than this. Currently they are producing more than 25,000 different parts for all types of airplanes.

power packages by ROHR

WORLD'S LARGEST PRODUCER OF READY-TO-INSTALL POWER PACKAGES FOR AIRPLANES

ROHR
AIRCRAFT CORPORATION

CHULA VISTA AND RIVERSIDE CALIFORNIA

Foreign Military & Civil Aircraft

Manufacturer and Address	Designation		Mission	Seats: No. of crew; passengers	Powerplants: Number, make, model and max. takeoff power of engine	Max. speed (mph.)	Fuel: Normal fuel capacity (gal.)	Weights: Max. gross weight (lb.)	Weights: Empty weight (lb.)	Dimensions: Overall span	Dimensions: Overall length	Dimensions: Overall height	Dimensions: Wing area (sq. ft.) including ailerons
AUSTRALIA													
Commonwealth Aircraft Corp. Pty. Ltd. *Fishermen's Bend*	C.A. 25	Winjeel	Trainer	3	1 P&W R985-SB-3 @ 450 hp.	187	86.5	4,235	3,240	38′ 9″	27′ 2″	9′	249
	C.A. 27	Sabre Mk. 30	Fighter	1	1 R-R Avon 20 @ 7,500 lb.t.	700*	425	20,000*	11,000*	37′ 1″	37′ 6″	14′ 8″	287.9
Government Aircraft Factories *Fishermen's Bend*		Canberra B.20	Bomber	2	2 R-R Avon			51,000		64′	65′ 6″	15′ 8″	960
CANADA													
Canadair Ltd. *Montreal, P. Q.*	CL-21		Transport	32	2 Wr. 9HE @ 1,500 hp.			32,000*		90′	67′ 6″	25′ 3″	
	Sabre 5		Fighter	1	1 AvC Orenda @ 6,500 lb. t.	700*				37′*	37′*	14′*	
de Havilland Aircraft of Canada, Ltd. *Toronto, Ont.*	D.H.C.2	Beaver	Transport	1:6	1 P&W R985 @ 450 hp.	163	95	5,100	2,960	48′	30′	10′ 5″	250
	D.H.C.3	Otter	Transport	1:10–14	1 P&W R1340 @ 600 hp.	160	214	7,600	4,345	58′	41′ 10″	13′	375
A. V. Roe Canada Ltd. *Malton, Ont.*	CF-100 Mk 4		AW Fighter	2	2 AvC Orenda 9	650*		34,000*		52′	52′ 4″	15′ 1″	540
GREAT BRITAIN													
Sir W. G. Armstrong Whitworth Aircraft Ltd. *Baginton nr. Coventry*		Meteor N.F.12	AW Fighter	2	2 R-R Derwent					43′	50′*	13′ 11″	374
Auster Aircraft Ltd. *Rearsby Aerodrome* *Rearsby, Leicester*	J.5B	Autocar	Personal	1:3	1DH Gipsy Major 1 @ 120 hp.	116	38.5	2,400	1,413	36′	23′ 2″	8′ 3″	184.5
	J.5F	Aiglet	Trainer	1:2	1 DH Gipsy Major 1 @ 120 hp.	126.5	38.5	1,950	1,324	32′	23′ 2″	8′ 3″	164
	J.5F	Aiglet	Personal	1:2	1 DH Gipsy Major 1 @ 120 hp.	122.5	38.5	2,200	1,324	32′	23′ 2″	8′ 3″	164
	J.5G	Autocar	Personal	1:3	1 Bl. Cirrus Maj. 3 @ 140 hp.	126	38.5	2,450	1,367	36′	23′ 7½″	8′ 6″	184.5
	A.O.P.9		Liaison	2	1 Bl. Bombadier @ 172 hp.					36′ 5″	23′ 8½″	8′ 5″	
Aviation Traders Ltd. *London*	Accountant		Transport	22–36	2 R-R Dart 6	290*		24,000					
Blackburn & General Aircraft Ltd. *Brough, E. Yorkshire*	G.A.L.60	Beverley	Transport	4	4 Br. Centaurus					162′	99′ 2″	38′ 8″	2,916
		Universal Transport	Transport	2:170	4 Br. Centaurus 173 @ 2,850 hp.	234	4,320	135,000	78,500	162′	99′ 2″	38′ 8″	2,916
Boulton Paul Aircraft Ltd. *Wolverhampton*	P.108A	Balliol T.2	Trainer	2	1 R-R Merlin 35 @ 1,280 hp.	292	150	8,410	6,730	35′ 1″	39′ 1″	12′ 6″	250
	P.111A		Research	1	1 R-R Nene					33′ 6″	26′ 1″	12′ 6″	
Bristol Aeroplane Co., Ltd. *Filton House, Bristol*	170	Freighter 31	Transport	3;56	2 Br. Hercules 734 @ 2,020 hp.	230		44,000	25,547	108′	68′ 4″	26′ 3½″	1,487
	175	Britannia 100	Transport	8;92	4 Br. Proteus 705 @ 3,780 eshp.		8,100	140,000	77,750	142′ 3½″	114′	36′ 8½″	2,055
	175	Britannia 250	Transport	8–9;87	4 Br. Proteus 755 @ 4,150 eshp.			155,000	80,860	142′ 3½″	124′ 3″	36′ 8½″	2,055
	175	Britannia 300	Transport	8–9;101	4 Br. Proteus 755 @ 4,150 eshp.			155,000	80,435	142′ 3½″	124′ 3″	36′ 8½″	2,055
de Havilland Aircraft Co., Ltd. *Hatfield, Hertfordshire*	D.H.100	Vampire F.B.5	Fighter	1	1 DH Goblin 3 @ 3,350 lb. t.	550	475	12,350	7,280	38′	30′ 9″	6′ 2″	262
	D.H.115	Vampire T.11	Trainer	2	1 DH Goblin 35 @ 3,550 lb. t.	549	396	11,030	9,900	38′	34′ 6″	7′	262
	D.H.104	Dove	Transport	2;8–11	2 DH Gipsy Queen @ 380 hp.	210	264	8,800	6,040	57′	39′ 6″	13′ 4″	335
	D.H.106	Comet 1	Transport	4;36	4 DH Ghost 50 @ 5,000 lb. t.		7,200	105,000		115′	93′	28′	2,015
	D.H.106	Comet 1A	Transport	4;44	4 DH Ghost 50 @ 5,000 lb. t.		8,400	115,000		115′	93′	28′	2,015
	D.H.106	Comet 2	Transport	4;44	4 R-R Avon 503 @ 7,000 lb. t.	500+	8,400	120,000		115′	93′	28′	2,015
	D.H.106	Comet 3	Transport	4;58–76	4 R-R Avon 16 @ 9,000 lb. t.	500+	9,600+	145,000		115′	111′		2,015
	D.H.110		AW Fighter	2	2 R-R Avon	700+				52′ 1¾″	51′		
	D.H.112	Venom F.B. 1	Fighter	1	1 DH Ghost	600+				41′ 8″	31′ 10″		
	D.H.112	Venom N.F. 13	AW Fighter	2	1 DH Ghost @ 5,000 lb. t.	600*				41′ 10″	31′ 11″		
	D.H.112	Sea Venom N.F. 21	AW Fighter	2	1 DH Ghost @ 5,000 lb. t.	600*							
	D.H.114	Heron 1	Transport	2;14–17	4 DH Gipsy Queen @ 250 hp.		380	13,000	7,854	71′ 6″	48′ 6″	14′ 2″	499
	D.H.114	Heron 2	Transport	2;14–17	4 DH Gipsy Queen @ 250 hp.		380	13,000	8,019	71′ 6″	48′ 6″	14′ 2″	499
	D.H.C.1	Chipmunk	Trainer	2	1 DH Gipsy Major 8 @ 145 hp.	138	24	2,000	1,417	34′ 4″	25′ 8″	7′ 1″	172.5
(Airspeed Division) *Christchurch, Hampshire*	A.S.57	Ambassador	Transport	3;40–49	2 Br. Centaurus 661 @ 2,600 hp.	300	1,200	52,500	35,781	115′	81′	18′ 4″	1,200
English Electric Co., Ltd. *London*		Canberra B.2	Bomber	3	2 R-R Avon					64′	65′ 6″	15′ 7″	960
		Canberra T.4	Trainer	3	2 R-R Avon					64′	65′ 6″	15′ 7″	960
		Canberra P.R.7	Photo	2	2 R-R Avon					64′	66′ 8″	15′ 7″	960
Fairey Aviation Co., Ltd. *Hayes, Middlesex*	F.D.1		Research	1	1 R-R Derwent @ 3,500 hp.					19′ 7″	26′ 3″		
		Firefly A.S.7	ASW	3	1 R-R Griffon 50 @ 2,470 hp.					44′ 6″	38′ 3″	15′	
		Gannet A.S.1	ASW	3	1 AS Double Mamba @ 2,950 hp.					54′ 4″	43′	13′ 8½″	
Gloster Aircraft Co Ltd. *Hucclacote, Gloucester*		Meteor T.7	Trainer	2	2 R-R Derwent 8 @ 3,600 lb. t.	598	700	14,100	10,575	37′ 2″	43′ 6″	13′	350
		Meteor F.8	Fighter	1	2 R-R Derwent 8 @ 3,600 lb. t.	598	795	15,700	10,570	37′ 2″	44′ 7″	13′	350
		Meteor F.R.9	Reconn.	1	2 R-R Derwent 8 @ 3,500 lb. t.	598	795	15,660	10,768	37′ 2″	43′ 6″	13′	350
		Javelin F.1	AW Fighter	2	2 AS Sapphire @ 8,000 lb. t.	700+		27,000*		52′	57′	16′ 3″	920*
Handley Page Ltd. *Cricklewood, London*	H.P.80	Victor	Bomber		4 AS Sapphire @ 8,000 lb. t.	600*				120′*			
		Marathon T.2	Trainer	5	4 DH Gipsy Queen @ 340 hp.	198	501	17,535	13,358	65′	52′ 1¾″	14′	498
	H.P.R.3		Transport	2:36–44	4 Al. Leonides @ 870 hp.	273	844	33,500	20,132	95′	70′ 3″	22′ 6″	882
Hawker Aircraft Ltd. *Kingston-on-Thames* *Surrey*		Sea Hawk	Fighter	1	1 R-R Nene 4 @ 5,000 lb. t.	600*				39′	40′	8′ 9″	278
	P.1067–1	Hunter F.1	Interceptor	1	1 R-R Avon 7 @ 7,500 lb. t.	700+				33′ 8″	45′ 3″		
	P.1067–2	Hunter F.2	Interceptor	1	1 AS Sapphire @ 8,500 lb. t.	700+				34′*	45′*		
Percival Aircraft Ltd. *Luton, Bedfordshire*	P.50	Prince 5	Transport	1–2;10–12	2 Al. Leonides 24 @ 550 hp.	229	226	12,500	8,038	64′ 6″	42′ 10″	16′ 1″	400
	P.56	Provost T.1	Trainer	2	1 Al. Leonides 25 @ 550 hp.	200	79	4,250	3,321	35′ 2″	29′	12′	214
A. V. Roe & Co. Ltd. *Greengate, Middleton,* *Manchester*	696	Shackleton G.R.2	ASW	10	4 R-R Griffon					120′	77′ 6″	17′ 6″	1,421
	698	Vulcan B.2	Bomber		4 Br. Olympus	600*							
	707A		Research	1	1 R-R Derwent					34′ 2″	42′ 9″	11′ 9″	
	707B		Research	1	1 R-R Derwent					33′	41′	11′ 9″	
	707C		Research	2	1 R-R Derwent					34′ 2″	42′ 3½″		

(Footnotes on page 212)

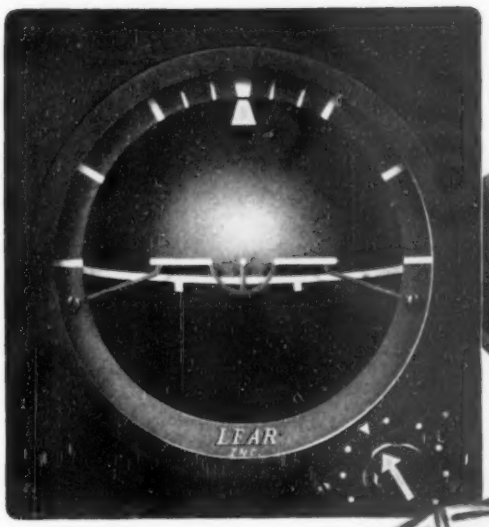
LEAR VGI SYSTEM ...SIXTH SENSE FOR THE BOEING B-47

IN HIGH-SPEED maneuvering hazardous errors are introduced by conventional attitude indicating instruments. For greater safety, the jet plane needs something *special* in the way of an attitude indicator. For the Boeing B-47 and other jet bombers and fighters, this critical function is performed by the Lear Vertical Gyro Indicator System.

Operating as the plane's "sixth sense," the Lear VGI system is designed to measure and display deviation from horizontal flight with near-perfect accuracy and speed. All necessary gyros, amplifiers, and power supplies are contained in one compact unit which is remotely installed, transmitting pitch and roll intelligence electrically to the flight attitude indicator. The Lear VGI may also be used as a master vertical reference for an autopilot, radar, or other equipment.

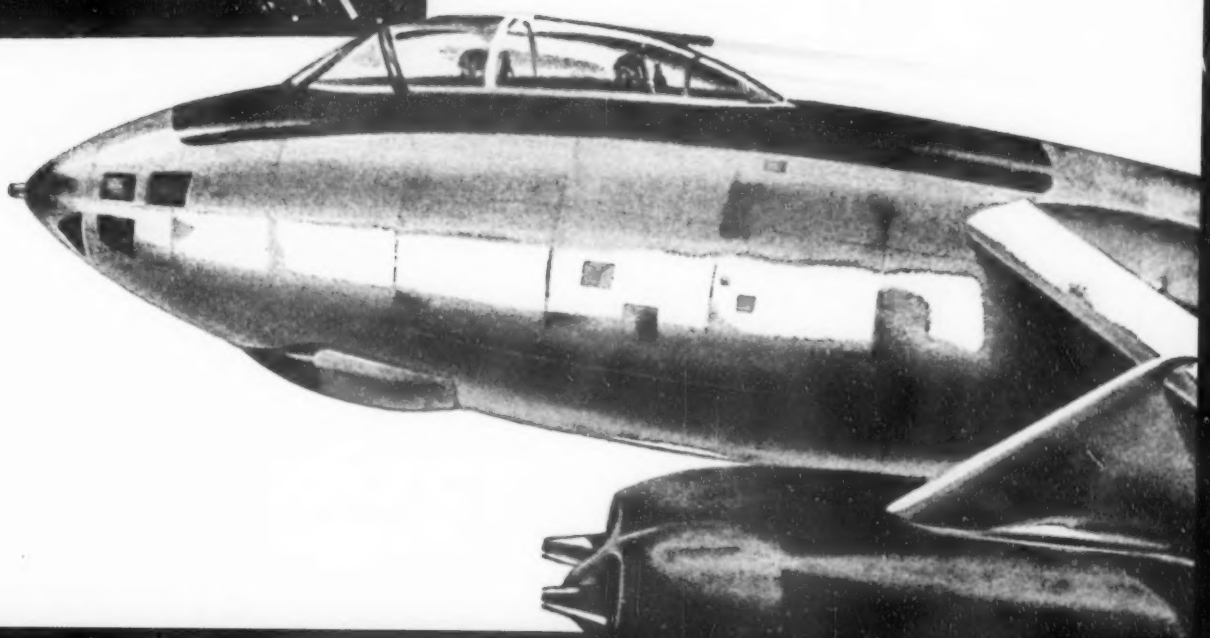
Let us discuss *your* problems in instrumentation. We have been solving the tough ones for almost a quarter of a century.

LEAR INC. GRAND RAPIDS DIVISION
110 IONIA AVE., N. W., GRAND RAPIDS 2, MICHIGAN
Executive Offices: 3171 S. Bundy Dr., Los Angeles 34, California



LEAR VGI SYSTEM Non-tumbling horizon gyro (in roll), provides greatly improved accuracy, reduced turn errors. The system includes 24,000 rpm gyro motor and a highly sensitive Lear electrolytic erection switch.

IP-3

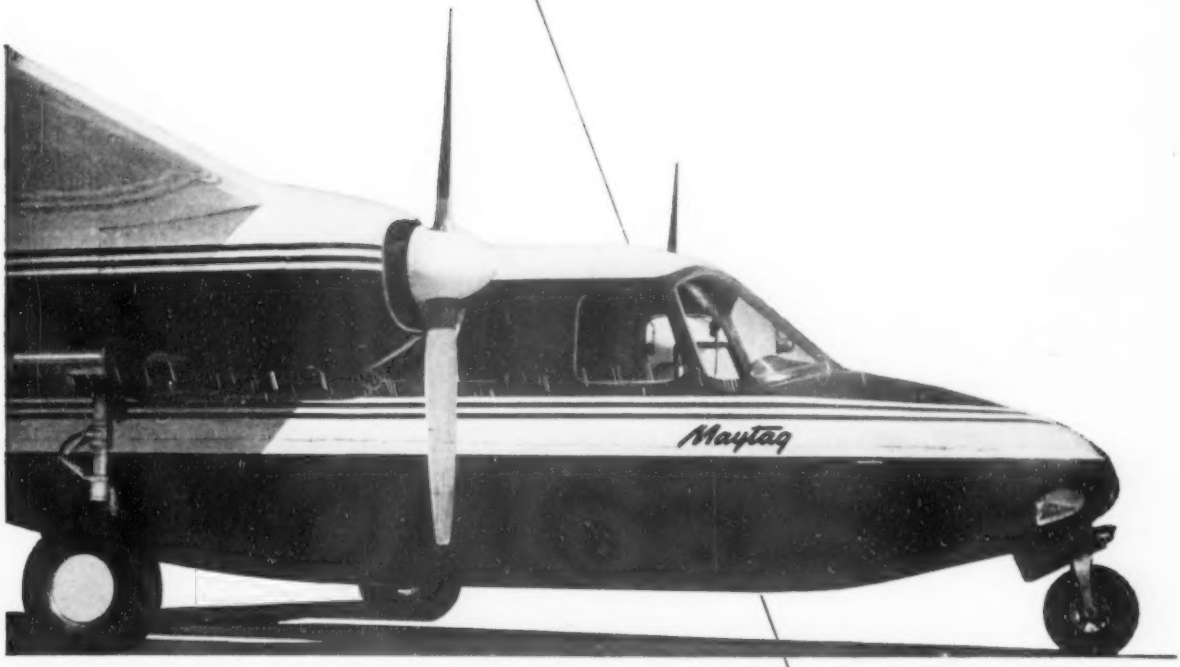


Foreign Military & Civil Aircraft

Manufacturer and Address	Designation		Mission	Seats: No. of crew; passengers	Powerplants: Number, make, model and max. takeoff power of engine	Max. speed (mph.)	Fuel: Normal fuel capacity (gal.)	Weights: Max. gross weight (lb.)	Weights: Empty weight (lb.)	Dimensions: Overall span	Dimensions: Overall length	Dimensions: Overall height	Dimensions: Wing area (sq. ft.) including ailerons
Saunders-Roe Ltd. *Osborne, E. Cowes, Isle of Wight*	S.R.45	Princess	Transport	12;182	6 Turboprop	.....	17,400	345,000	172,800	219′ 6″	157′ 4″	60′ 9″	5,019
Scottish Aviation Ltd. *Ayrshire, Scotland*	.....	Pioneer 2	Personal	5	1 AL Leonides 502-4 @ 520 hp.	160	79	5,400	4,090	49′ 9″	34′ 6″	10′	390
	.....	Twin-Pioneer	Transport	1;16	2 AL Leonides 502-1 @ 560 hp.	181	192	13,500	9,075	78′ 6″	45′ 1″	13′ 8″	657
Short Bros. & Harland Ltd. *Queens Island, Belfast Northern Ireland*	S.A.4	.....	Bomber	.....	4 R-R Avon lb. t.	.....	.....	.....	.....	109′	102′ 2″	25′ 6″	1896.7
	S.B.5	.....	Research	1	1 R-R Derwent lb. t.	.....	.....	.....	.....	.....	.....	.....	.....
	S.A.6	Sealand	Transport	1-2;5-8	2 DH Gipsy Queen @ 340 hp.	185	142.8	9,100	7,232	61′ 6″	42′ 2″	14′ 1″	358.6
	S.B.4	Sherpa	Research	1	2 Bl. Turbomeca @ 350 lb. t.	.....	.....	.....	.....	38′	31′ 3″	9′ 1½″	.....
	S.B.6	Seamew	ASW	3	1 AS Mamba	.....	.....	.....	.....	55′	41′	15′ 9″[4]	.....
Vickers-Armstrongs Ltd. *Weybridge, Surrey*	660	Valiant B.2	Bomber	.....	4 R-R Avon	.....	.....	.....	.....	.....	.....	.....	.....
	700	Viscount	Transport	2-3;40-62	4 R-R Dart @ 1,400 hp.[3]	340	1,720	58,500	33,950	94′	81′ 2″	26′ 9″	963
	1000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
(Supermarine Works) *South Marston*	398	Attacker F.B.2	Fighter	1	1 R-R Nene 102 @ 5,000 lb. t.	585	352	12,300	8,434	36′ 11″	37′ 6″	9′ 6½″	227
	508	.....	Fighter	1	2 R-R Avon	650+	.....	.....	.....	41′	50′	.....	.....
	.....	Swift F.4	Fighter	1	1 R-R Avon	.....	.....	.....	.....	.....	.....	.....	.....
Westland Aircraft Ltd. *Yeovil, Somerset*	W.35	Wyvern S.4	Attack	1	1 AS Python 3 @ 4,110 hp.	.....	632	24,300	15,290	44′	42′	14′ 5″	355
FRANCE													
Constructions Aeronautique du Bearn *Pau*	.....	Minicab	Personal	2	1 Con. A65 @ 65 hp.	125	13	1,068	594	25′	18′	5′ 5″	107
Avions Boisavia *Ivry sur-Seine*	B.60	Mercurey	Personal	4	1 Renault 4 Pei @ 140 hp.	145	.....	2,645	1,443	36′ 11″	23′	8′ 10″	194
S. A. des Ateliers d'Aviation Louis Breguet *Paris*	76-3	Deux-Ponts	Transport	3;106	4 P&W R2800 @ 2,400 hp.	250	3,366	105,727	55,903	140′ 10″	94′ 11″	31′ 4″	1,965
	960	Vultur	Attack	2	1 AS Mamba @ 2,950 hp.	560	.....	22,204	15,423	54′ 3″	43′ 4″	16′ 8″	.....
Avions Marcel Dassault *Paris*	M.D.315	Flamant	Transport	2;10	2 Renault 12-S (@ 580 hp.	236	.....	12,865	9,369	60′	42′	15′	500
	M.D.450	Ouragon	Fighter	1	1 Hisso Nene @ 5,066 lb. t.	613	250	11,684	7,246	38′ 7″	34′ 9″	13′	269
	M.D.452	Mystere 2	Fighter	1	1 Hisso Tay @ 6,270 lb. t.	700	.....	13,000*	.....	36′*	36′*	.....	.....
	.....	Mystere 4	Fighter	1	1 Hisso Verdon @ 8,000 lb. t.	700	.....	.....	.....	.....	.....	.....	.....
Avions Hurel-Dubois *Mendon-Villacoublay*	H.D.10	.....	Research	1	1 Praga D @ 75 hp.	161	.....	1,144	726	39′ 4″	16′ 10″	.....	494
	H.D.31	.....	Transport	3;36	2 Wr. C7RA1 @ 800 hp.	174	.....	29,832	18,884	147′ 7″	72′ 3″	21′ 10″	1,077
	H.D.32	.....	Transport	3;42	2 P&W R1830-92 @ 1,200 hp.	185	.....	38,170	22,176	147′ 7″	72′ 3″	21′ 10″	1,077
	H.D.45	.....	Transport	90	2 Turbojet @ 9,000 lb. t.	.....	.....	90,405	.....	147′ 7″	.....	.....	1,184
Ets Fouga & Cie *Paris*	C.M.8R98	Cyclope 3	Trainer	1	1 Turbomeca Palas @ 330 lb. t.	215	.....	1,255	902	28′ 9″	21′ 10″	5′ 10″	105
	C.M.170R	Magister	Trainer	2	2 Turbomeca Marbore @ 836 lb. t.	420	170	5,795	3,850	37′ 6″	32′ 3″	.....	186
Societe Francaise D'Etudes et de Construction de Materiels Aeronautiques Speciaux *Chatillon-Sous-Bagneux*	1402	Gerfaut	Fighter	1	1 Atar 101C @ 6,160 lb. t.	.....	.....	.....	.....	.....	.....	.....	.....
Societe Max Holste *Paris*	M.H.1521	Broussard	Personal	1;5	1 P&W R985 @ 455 hp. lb.t.	162	.....	5,202	3,212	45′	27′	.....	.....
Societe Morane-Saulnier *Puteaux (Seine)*	M.S.733	.....	Trainer	3	1 Potes 6D30 @ 240 hp	164	60	3,800	2,800	37′	31′ 2″	11′ 4″	236
	M.S.755	.....	Trainer	2	2 Turbomeca Marbore @ 880 lb. t.	430+	165	5,835	4,409	31′	31′ 2″	8′	194
Societe Industrielle pour L'Aeronautique *Suresnes*	S.12	.....	Trainer	2	1 Snecma 12S @ 494 hp.	216	90	5,026	4,035	36′ 1″	30′ 8″	8′	199
	S.200	.....	Personal	2	1 Turbomeca Palas @ 330 lb. t.	267	.....	1,606	869	33′ 6″	17′	5′ 10″	85
	S.901	.....	Trainer	2	1 Minie 4DC30 @ 75 hp.	124	.....	1,320	805	28′ 8″	18′ 10″	5′ 9″	120
Societe Nationale de Constructions Aeronautiques du Sud-Est *Paris*	S.E. 210	Caravelle[7]	Transport	5;70	2 Hisso Avon R.A. 16 @ 9,000 lb.t.	.....	4,500	84,480	41,800	112′ 6″	103′ 4″	29′ 4″	1,571
	S.E.2010	Armagnac	Transport	7-11;80-107	4 P&W R4360-B-13 @ 3,500 hp.	299	6,908	165,000	84,070	139′ 1″	128′ 9″	42′ 7″	2,453
	S.E.2410	Grognard	Attack	2	2 Hisso Nene @ 5,066 lb. t.	598	.....	36,116	.....	50′ 7″	54′ 9″	19′	469
	.....	Mistral	Fighter	1	1 Hisso Nene 102 @ 5,066 lb. t.	578	.....	10,000	7,700	38′ 8″	31′	.....	260*
	S.E.5000	Baroudeur	Fighter	1	1 Snecma Atar 101C @ 6,160 lb. t.	650	.....	.....	.....	32′ 10″	44′ 3″	11′ 9″	.....
Societe Nationale de Constructions Aeronautiques du Sud-Ouest *Paris*	S.O.30-P	Bretagne	Transport	4;30-43	2 P&W R2800 @ 2,400 hp	267	1,270	44,300	29,550	82′ 2″	62′ 2″	16′ 1″	927.5
	S.O.30 Nene	.....	Transport	4	2 Hisso Nene @ 5,300 lb. t.	465	1,640	38,600	27,500	84′ 7″	61′	.....	916
	S.O.4050	Vautour	Attack	1	2 Atar 101B @ 5,280 lb. t.	600*	.....	.....	.....	.....	.....	.....	.....
	S.O.9000	Trident	Fighter	1	2 Turbomeca Marbore 2 @ 880 lb. t[8]	800*	.....	.....	.....	.....	.....	.....	.....
Societe Des Avions et Moteurs Henry Potez *Paris*	75	.....	Attack	2	1 Potes 8D32 @ 450 hp	.....	.....	5,280	3,685	42′ 8″	32′ 10″	.....	.....
HOLLAND													
Royal Dutch Aircraft Factories (Fokker) *Schiphol, Amsterdam*	S.11	Instructor	Trainer	2	1 Lyc. O435-A @ 190 hp.	130	37	2,425	1,785	36′ 2″	27′	7′ 11″	199
	S.12	Instructor	Trainer	2	1 Lyc. O435-A @ 190 hp.	125	37	2,470	1,830	36′ 2″	27′	10′ 2″	199
	S.13	.....	Trainer	2	2 P&W R1340 @ 600 hp.	220	325	12,730	9,225	63′	44′ 7″	18′	495
	S.14	.....	Trainer	2	1 R-R Derwent 8 @ 3,470 lb. t.	455	450	11,800	8,300	39′ 5″	43′ 8″	15′ 4″	343
	S.14-2	.....	Trainer	2	1 R-R Nene 2-9 @ 5,100 lb. t	530	450	12,350	.....	39′ 5″	43′ 8″	15′ 4″	342
	F.27	Friendship	Transport	3;28-36	2 R-R Dart @ 1,680 hp.	280	845	34,200	20,610	95′	73′	28′ 6″	754

(Footnotes on page 212)

a nose for business



MAYTAG—another famous trade-mark on the nose of an Aero Commander. American Industry is finding the five-to-seven-place, twin-engine Aero Commander the perfect executive transport for speeding up and expanding their operations through greater utilization of the time of key personnel.

AERO DESIGN Commander

AERO DESIGN AND ENGINEERING COMPANY

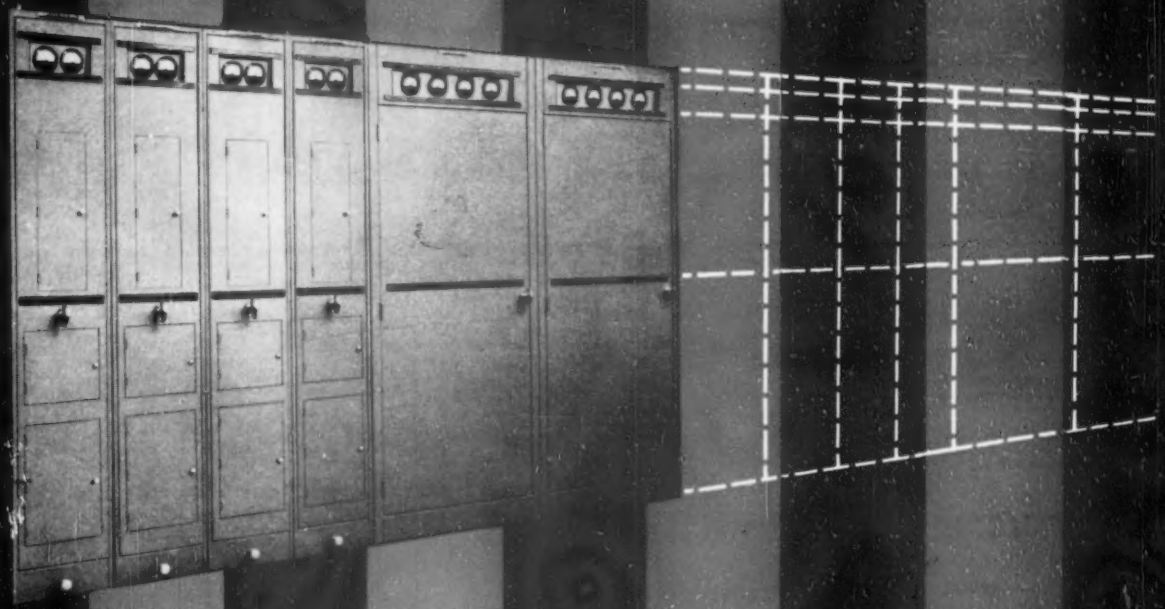
TULAKES AIRPORT P. O. BOX 118 • BETHANY, OKLA

Foreign Military & Civil Aircraft

Manufacturer and Address	Designation		Mission	Seats: No. of crew; passengers	Powerplants: Number, make, model and max. takeoff power of engine	Max. speed (mph.)	Fuel: Normal fuel capacity (gal.)	Weights: Max. gross weight (lb.)	Weights: Empty weight (lb.)	Dimensions: Overall span	Dimensions: Overall length	Dimensions: Overall height	Dimensions: Wing area (sq. ft.) including ailerons
ITALY													
S. A. I. Ambrosini *Rome*	S.7	Supersette	Personal	1–2	1 Alfa Romeo 115 @ 230 hp.	173	40	3,050	2,365	28′ 9″	28′ 9″	9′ 2″	137.8
	G.F.4	Rondone	Personal	2	1 Walter Mikron @ 65 hp.	140	18.5	1,210	748	28′ 2½″	20′ 2″	9′ 2″	114
Soc. Aero Caproni *Trento*	F.5		Trainer	2	1 Turbomeca Palas @ 330 lb. t.	242	39.6	1,650	1,032	25′ 9″	21′ 9″	8′	107
FIAT—Sezione Aeritalia *Turin*	G.46-2B		Trainer	2	1 DH Gipsy Queen @ 245 hp.	204	42	3,150	2,450	34′ 1½″	27′ 10″	7′ 10½″	172.2
	G.46-4B		Trainer	2	1 Alfa Romeo 115 @ 222 hp.	194	42	3,145	2,425	34′ 1½″	27′ 10″	7′ 10½″	172.2
	G.49-1		Trainer	2	1 Al. Leonides @ 570 hp.	225	90	6,090	4,810	40′ 11″	31′ 5″	9′ 1″	255
	G.49-2		Trainer	2	1 P&W R1340 @ 600 hp.	230	90	6,090	4,810	40′ 11″	30′ 10″	9′	255
	G.59-4A		Trainer	1	1 R-R Merlin @ 1,400 hp.	380	127	7,630	6,180	38′ 10½″	31′ 1″	12′ 1″	227
	G.59-4B		Trainer	2	1 R-R Merlin @ 1,400 hp.	380	100	7,465	6,285	38′ 10½″	31′ 1″	12′ 1″	227
	G.80-3B		Trainer	2	1 DH Goblin 35 @ 3,500 lb. t.	535	370	12,570	9,260	36′ 1″	41′ 10″	13′ 3″	270.6
	G.82		Trainer	2	1 R-R Nene @ 5,000 lb. t.	565	475	13,800	9,700	39′ 1″	42′ 5″	13′ 5″	270.6
	G.212-CP	Monterosa	Transport	4;26–30	3 P&W R1830 @ 1,200 hp.	236	1,185	39,700	24,700	96′ 3″	75′ 7½″	21′ 4″	1,255
Aeronautica Macchi *Varese*	M.B.308		Personal	2	1 Con. C85 @ 85 hp.	118	22	1,433	915*	32′ 9″	21′ 5″	7′ 1″	147.5
	M.B.320		Personal	1;5	2 Con. E185 @ 185 hp.	200	95	4,960	3,284[5]	42′ 7″	28′ 5″	10′ 6″	227.1
	M.B.323		Trainer	1	1 P&W R1340-S1H1 @ 610 hp.	236	116	5,500	4,245	39′ 6″	30′	13′ 3″	216
SIAI-Marchetti *Sesto Calende*	S.M.102		Transport	2;8–10	2 P&W R985 @ 450 hp.	215	198	11,125	7,600	59′	43′	10′ 5″	437
Nardi Soc. per Construzioni Aeronautiche *Milan*	F.N.333		Personal	1;3	1 Con. 047-A 225 hp.	168	44	2,650	1,625	32′ 8″	23′	8′ 9″	145.3
Piaggio & Co. S. p. a. *Genoa*	P.136-L		Personal	1;4	2 Lyc. GO435-C2 @ 260 hp.	173	160	5,730	3,900	44′ 5″	35′ 5″	11′ 6″	268
	P.136-M		Rescue	2;2	2 Fr. 6A8-215-B9F @ 215 hp.	164	160	5,400	4,120	44′ 5″	35′ 5″	11′ 6″	268
	P.148		Trainer	2	1 Lyc. O435-A @ 190 hp.	145	45	2,645	1,931	36′ 6″	27′ 8″	7′ 10½″	202.5
	P.149		Personal	1;3	1 Lyc. GO 435-C2 @ 260 hp.	184	69	3,105	2,190	36′ 6″	28′ 1″	9′ 6″	202.5
	P.150		Trainer	2	1 P&W R1340-S3H1 @ 600 hp.	237	164	5,600	4,277	42′ 4″	30′ 4″	9′ 2″	271.3
SWEDEN													
Svenska Aeroplan A.B. *Linkoping*	Saab-29	J-29	Fighter	1	1 DH Ghost @ 5,000 lb. t.	660	.....	.....	.....	36′ 1″	33′ 2½″	12′ 3½″	258
	Saab-29C	S-29C	Photo	1	1 DH Ghost @ 5,000 lb. t.	660	.....	.....	.....	36′ 1″	33′ 2½″	12′ 3½″	258
	Saab-32	A-32 Lansen	Attack	2	1 R-R Avon	700+	.....	22,000*	.....	42′ 8″	49′ 2″	16′ 5″	.....
	Saab-90A-2	Scandia	Transport	2–5;32–40	2 P&W R2180E-1 @ 1,800 hp.	280	770	35,280	21,960	91′ 10″	69′ 11″	23′ 3″	922
	Saab-91C	Safir	Personal	4	1 Lyc. O435-A @ 190 hp.	168	40	2,686	1,650	39′ 9″	26′	7′ 2″	146
	Saab-210	Draken	Research	1	1 AS Adder @ 1,050 lb. t.	.....	.....	.....	.....	.....	.....	.....	.....

* — Approximate.
Al. — Alvis.
AS — Armstrong Siddeley.
ASW — Anti-submarine warfare.
AvC — A. V. Roe Canada.
AW — All weather.
Bl. — Blackburn.
Br. — Bristol.
Con. — Continental.
DH — de Havilland.
Fr. — Franklin (Aircooled Motors).
Hp. — Horsepower.
Lyc. — Lycoming.
P&W — Pratt & Whitney Aircraft.
Recon. — Reconnaissance.
R-R — Rolls-Royce.
Wr. — Wright.

[1] Freighter Mk. 32 carries 20 passengers. Length is 73′ 6″.
[2] Retractable tricycle landing gear. Heron 1 has fixed gear. Two prototypes being built.
[4] Wings folded.
[5] Cruise power is 1,550 hp. Later versions have 1,550 hp. on takeoff.
[6] Plus a 5,000-lb. thrust Hisso Nene turbojet in the tail.
[7] Two prototypes being built.
[8] Engines mounted at wingtips. A SEPR rocket motor will be located in the tail.
[9] Being produced under Saab subcontract by the Dutch De Schelde plant at Dordrecht, which is also making the three-place Saab-91B under a similar contract.



FLEXIBLE

Dependable

wilcox

96 Series

TRANSMITTING STATION

Unit construction means either simultaneous transmission on a number of frequencies or selection of single channel best suited to your communication problem. 125–525 kc/s . . . 2400 watts. 2–26 mc/s . . . 2500 watts. Meters, transformers, capacitors are hermetically sealed for failure-proof performance.

Write today for complete specifications.

wilcox

ELECTRIC COMPANY, INC.

Fourteenth & Chestnut

Kansas City 27, Missouri, U.S.A.

Leading Foreign Helicopters

Manufacturer and Address	Designation		Seats (including crew)	Powerplant: Number, make, model and takeoff power of engine	Performances: Maximum speed (mph.) @ SL	Performances: Initial rate of climb (fpm.) @ SL, fully loaded	Performances: Hovering ceiling (ft.) in ground effect	Performances: Normal still air range (mi.)	Fuel: Normal fuel capacity (gal.)	Weights: Allowable takeoff gross weight (lb.)	Weights: Empty weight (lb.)	Main Rotor: No. of rotors	Main Rotor: Blades per rotor	Main Rotor: Rotor diameter	Main Rotor: Total rotor blade area (sq. ft.)	Dimensions: Max. length (blades unfolded)	Dimensions: Fuselage maximum width	Dimensions: Overall height to top of rotor
GREAT BRITAIN																		
Bristol Aeroplane Co., Ltd. *Filton, Bristol*	171 Mk. 4 173 Mk. 3	Sycamore Rotocoach	4-5 16	1 Al. Leonides @ 545 hp. 2 Al Leonides @ 850 hp.	126 153	....	 11,000	233 187	65 288	5,400 13,500	3,977 9,300	1 2	3 3	48′ 7″ 48′ 7″	....	61′ 1″	....	9′ 4″ 14′
Fairey Aviation Co., Ltd. *Hayes, Middlesex*	.....	Rotodyne [1]	40+	2 turbine	....	.....	.....	400*	....	31,000	18,000*	...	5	80′	.....	.....	.....	.....
Percival Aircraft, Ltd. *Luton, Bedfordshire*	P. 47	.....	10	1 Napier jet	....	.....	.....	.....	.....	8,000	4,900*	1	3	.....	.....	.....	.....	.....
Saunders-Roe Ltd. *Osborne, E. Cowes, Isle of Wight*	.....	Skeeter	2	1 Bl. Bombardier @ 190 hp.	....	1,250	3,300	.....	27	2,100	1,476	1	3	32′	.....	28′ 5″	7′ 4½″	10′ 2″
Westland Aircraft Ltd. *Yeovil, Somerset*	S-51 S-55	Dragonfly	4-5 10-12	1 Al. Leonides @ 525 hp. 1 P&W R1340-40 @ 600 hp.	 111	750* 880	 6,000	220 430	70* 150	5,700* 6,800	4,235 4,780	1 1	3 3	49′ 53′	..... 97.5	..... 62′ 3″	..... 11′ 6″	13′ 13′ 1″
FRANCE																		
Societe Maira *Boulogne-sur-Seine*	M.C. 101	Cantinieau	2-3	1 Continental @ 135 hp.	....	.....	.....	.....	.....	1,325	882	1	3	25′ 3″	.....	22′	.....	7′ 6″
Societe Nationale de Constructions Aeronautiques du Sud-Est *Paris*	S.E. 3120	Alouette	3	1 Salmson 9NH @ 200 hp.	84	.....	.....	.....	.....	2,550	1,628	1	3	19′	.....	34′ 6″	.....	9′
Societe Nationale de Constructions Aeronautiques du Sud-Ouest *Paris*	S.O. 1110 S.O. 1220 S.O. 1310	Ariel 3 Djinn Farfadet[3]	3 2 5	1 Turbomeca @ 275 hp. 1 Turbo. Palouste 1 Turbo. Arius @ 360 hp.[2]	102 72 145[3]	....	5,900 3,280	155 800 240	....	2,750 1,100	1,496 594	1 1 1	3 2 3	35′ 5″ 28′ 2″ 36′ 8″	....	24′ 7″ 15′	....	..... 7′ 5″ .....

* — Approximate. AL. — Alvis. Bl. — Blackburn. P&W — Pratt & Whitney Aircraft. Turbo. — Turbomeca.

[1] Convertiplane.
[2] Rotor power unit. A 360-hp. Turbomeca Artouste turns the nose-mounted propeller. Wingspan is 20′ 8″. A larger, 30-passenger version is in the design stage.
[3] Design cruise speed.

BRISTOL 173 MK. 3 ROTOCOACH prototype is twin-engine 16-place type to be used by British European Airways on short hauls.

Douglas DC-7—America's newest and fastest commercial transport —uses SPS Precision Fasteners

A typical selection of SPS Fasteners. For information, write STANDARD PRESSED STEEL CO., Jenkintown 3, Pa.

AIRCRAFT PRODUCTS DIVISION SPS

JENKINTOWN PENNSYLVANIA

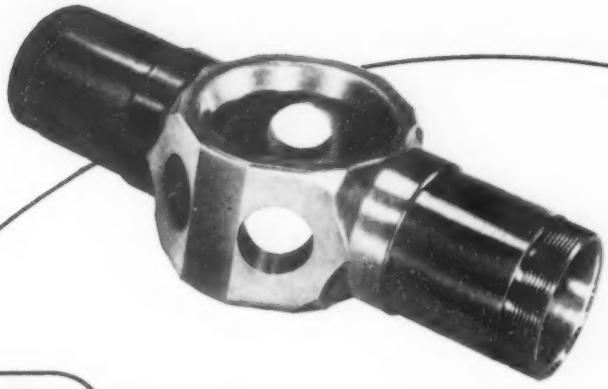
U. S. Reciprocating Engines

Manufacturer and Address	Designation		No. of cylinders	Cylinder arrangement	Propeller drive	Power Ratings: Max. takeoff power (hp.) — SL	At rpm.	Normal cruise power (hp.)	At rpm.	At altitude (ft.)	Octane fuel	Bore and stroke (in.)	Diameter (without cowling)	Compression ratio	Bmep.	Blower ratio	Gross weight dry (lb.)
Aircooled Motors, Inc. *Syracuse, N. Y.*	4A4-90-B3		4	Ho	Direct	90	2,300				80	4 5x3 5		7	138		200
	4A4-100-B3		4	Ho	Direct	100	2,550				80	4 5x3 5		7	138		200
	6A4-150-B3		6	Ho	Direct	150	2,600				80	4 5x3 5		7	136		278
	6A4-165-B3		6	Ho	Direct	165	2,800				80	4 5x3 5		7	140		278
	6V4-178-B32, B33[1]	0335-3,-4	6	Vo	Direct	178	3,000				80	4 5x3 5		7	140		294
	6AG4-185-B12		6	Ho	G .632:1	185	3,100				80	4 5x3 5		7 5	145		232
	6A4-200-C6		6	Ho	Direct	200	3,100				91	4 5x3 5		8 5	152		307
	6V4-200-C32[1], C33[1]	0335-5,-6	6	Vo	Direct	200	3,100				91	4 5x3 5		8 5	152		297
	6V6-245-B16F[1]	0425-1	6	Vo	Direct	245	3,275				80	4 7x4		7 5	140		372
Continental Motors Corp. *Muskegon, Mich.*	A65-8F		4	Ho	Direct	65	2,300				73	3 875x3 625		6 3	131		170
	C85-12F		4	Ho	Direct	85	2,575				73	4 062x3 625		6 3	139		182
	C90-12F		4	Ho	Direct	95	2,655				80/86	4 062x3 875		7	143		186
	C125-2		6	Ho	Direct	125	2,550				73	4 062x3 625		6 3	138		257
	C145-2		6	Ho	Direct	145	2,700				80/86	4 062x3 875		7	141		265
	O315A		4	Ho	Direct	150	2,600				80/86	5x4		7	143		263
	E185		6	Ho	Direct	205	2,600				80/86	5x4		7	135		355
	E225-8		6	Ho	Direct	225	2,650				80/86	5x4		7	143		385
	O470-A		6	Ho	Direct	225	2,600				80/86	5x4		7	143		352
	W670-23		7	Rad	Direct	240	2,200				80/86	5 125x4 625		6 1	130		485
	GE260-2		6	Ho	G .69:1	260	3,100				80/86	5x4		7			431
Herrmann Engineering Co. *Glendale, Calif.*	Cam Engine		12			200	1,900					3 25x3 75		8 5			264
Jacobs Aircraft Engine Co. *Pottstown, Pa.*	R755-A	R755-11	7	Rad	Direct	300	2,200				80	5 25x5	44"	6 0	144		505
	R755-B		7	Rad	Direct	275	2,200				80	5 25x5	44"	6 0	132		505
Lycoming Division of Avco Mfg. Corp. *Stratford, Conn.*	826C9HDE[2]		9	Rad	G .666:1	1,425	2,700				100/130	6 125x6 875	54 95"	6 80	229	7.21[3]	1,380
	853C7BA1[2]	R1300-1A	7	Rad	G .5625:1	800	2,600				91/98	6 125x6 312	50 45"	6.2	187	7.21	1,065
	863C9HD1[2]		9	Rad	Direct	1,425	2,700				100/130	6 125x6 875	54 95"	6 80	229	7.21[3]	1,350
	865C7BA1[2]	R1300-2	7	Rad	Direct	800	2,600				91/98	6 125x6 312	50 45"	6.2	187	7.21	1,056
	866C9HE1[2]		9	Rad	G .5625:1	1,475	2,700				100/130	6 125x6 875	54 95"	6 80	229	7.21	1,404
	867C9HE1[2]		9	Rad	G .5625:1	1,525	2,800				115/145	6 125x6 875	55.74"	6 80	236	7.21	1,445
	871C7BA1[2]	R1300-3	7	Rad	Direct	800	2,600				91/98	6 125x6 312	50 45"	6 2	187	7.21	1,080
	896C9HD1[2]		9	Rad	G .666:1	1,425	2,700				100/130	6 125x6 875	54 95"	6 80	229	7.21[3]	1,385
	895C9HE1[2]		9	Rad	Direct	1,525	2,800				115/145	6 125x6 875	55 74"	6 80	236	7.21[4]	1,460
	O235-C1		4	Ho	Direct	115	2,800	81	2,350	6,500	80	4 375x3 875	22 53x32"	6 75	140		236
	O290-D2		4	Ho	Direct	140	2,800	100	2,350	6,000	80/87	4 875x3 875	22 81x32 24"	7.51	137		260
	O320		4	Ho	Direct	150	2,700	112	2,450	7,000	80/87	5 125x3 875	24 68x32 24"	7 25	138		268
	O435-A		6	Ho	Direct	190	2,550	142	2,300	6,500	80/87	4 875x3 875	29 59x32 24"	6.5	136		392
	O435-H		6	Ho	Direct	200	2,800	142	2,300	6,500	80/87	4 875x3 875	24 65x32 24"	7	131		302
	O435-K[1]	O435-4	6	Ho	Direct	260	3,400	187	3,200	9,000	91/96	4 875x3 875	28 21x33 12"	7 3	140		383
	O435-V		6	Vo	Direct	260	3,400	196	3,100	5,000	80/87	4 875x3 875	33 12"	7 3	140		396
	GO435-C2		6	Ho	G .642:1	260	3,400	180	2,750	6,000	80/87	4 875x3 875	29 59x33 12"	7 3	140		422
	GSO435-B		6	Ho	G .642:1	300	3,400	195	2,750	10,000	91/98	4 875x3 875	32 36x33 12"	7 3	161	8.6	488
	GO-480		6	Ho	G .642	280	3,400	195	2,750	6,000	80/87	5 125x3 875	33 12"	7 3	136		432
	GSO480-B		6	Ho	G .642	340	3,200	210	2,750	18,000	100/130	5 125x3 875	33 12"	7 3	175	11.27	492
	GSO580-C		8	Ho	G .642:1	375	3,300	240	2,750	13,500	91/98	4 875x3 875	30 75x33 18"	7 3	156	7 91	592
	SO580-D[1]		8	Ho	Direct	400	3,300	262	2,750	11,000	100/130	4 875x3 875	30 75x33 18"	7 3	166	7 91	580
	GSO580-D	O580-1	8	Ho	G .642:1	400	3,300	262	2,750	11,000	100/130	4 875x3 875	30 75x33 18"	7 3	166	7 91	597
	SO580-V	O580-3	8	Vo	Direct	400	3,300	280	3,000	12,000	100/130	4 875x3 875	33.18"	7 3	166	7 9	585
Pratt & Whitney Aircraft Div. United Aircraft Corp. *East Hartford, Conn.*	R2000-D5		14	Rad	G .500:1	1,450	2,700	1,200	2,550	6,400	100/130	5 75x5 50	49 10"				1,585
	R2000-2SD13-G		14	Rad	G .500:1	1,450	2,700	1,200	2,550	5,000	100/130	5 75x5 50	49 10"				1,605
	R2800-CA3		18	Rad	G .450:1	2,400	2,800	1,800	2,600	6,000	100/130	5 75x6 00	52 80"				2,317
	R2800-CB3		18	Rad	G .450:1	2,400	2,800	1,800	2,600	8,500	100/130	5 75x6 00	52 80"				2,357
	R2800-CB4		18	Rad	G .450:1	2,500	2,800	1,800	2,600	8,500	108/135	5 75x6 00	52 80"				2,357
	R2800-CA15		18	Rad	G .450:1	2,400	2,800	1,600	2,600	16,000	100/130	5 75x6 00	52 80"				2,350
	R2800-CA18		18	Rad	G .450:1	2,400	2,800	1,600	2,600	14,500	100/130	5 75x6 00	52 80"				2,350
	R2800-CB16		18	Rad	G .450:1	2,400	2,800	1,600	2,600	16,000	100/130	5 75x6 00	52 80"				2,390
	R2800-CB17		18	Rad	G .450:1	2,500	2,800	1,700	2,600	14,500	108/135	5 75x6 00	52 80"				2,390
	R4360-CB2		28	Rad	G .375:1	3,500	2,700	2,650	2,550	5,500	108/135	5 75x6 00	55 00"				3,682
Wright Aeronautical Div. Curtiss-Wright Corp. *Wood-Ridge, N. J.*	745C18BA3		18	Rad	G .4375:1	2,200	2,800	1,400	2,300	12,100	100/130	6 125x6 312	55 8"	6 5	185	6.46[6]	2,780
	749C18BD1		18	Rad	G .4375:1	2,500	2,800	1,470	2,400	11,000	100/130	6 125x6 312	55 6"	6 5	211	6.46[5]	2,944
	826C9HD3, & 5	R1820-76A,-76B	9	Rad	G .666:1	1,425	2,700				100/130	6 125x6 875	54 95"	6 8	229	7.21[3]	1,380
	826C9HD4	R1820-101	9	Rad	G .5625:1	1,425	2,700				100/130	6 125x6 875	54 95"	6 8	229	7.21[3]	1,380
	836C18CA1	R3350-26WA	18	Rad	G .4375:1	2,700	2,900				115/145	6 125x6 312	55 6"	6 7	220	6.46[6]	2,848
	853C7BA1	R1300-1A	7	Rad	G .5625:1	800	2,600				91/98	6 125x6 312	50 45"	6 2	187	7.21	1,065
	863C9HD1	R1820-103	9	Rad	Direct	1,425	2,700				100/130	6 125x6 875	54 95"	6 80	229	7.21[3]	1,380
	856TC18DA1,2[8]	R3350-30W	18	Rad	G .4375:1	3,250	2,900				115/145	6 125x6 312	56 6"	6 70	265	6.46[6]	3,408
	865C7BA1	R1300-2	7	Rad	Direct	800	2,600				91/98	6 125x6 312	50 45"	6 2	187	7 21	1,056
	866C9HE1	R1820-80	9	Rad	G .5625:1	1,475	2,700				100/130	6 125x6 875	54 95"	6 8	229	7 21	1,380
	867C9HE1	R1820-82	9	Rad	G .5625:1	1,525	2,800				115/145	6 125x6 875	55.74"	6 8	236	7 21	1,445
	871C7BA1[2]	R1300-3	7	Rad	Direct	800	2,600				91/98	6 125x6 312	50 45"	6.2	187	7 21	1,080
	956C18CA1		18	Rad	G .4375:1	2,700	2,900	1,600	2,400	12,100	115/145	6 125x6 312	55 6"	6 7	220	6.46[6]	2,957
	957C7BA1		7	Rad	G .5625:1	800	2,600	490	2,130	10,500	91/98	6 125x6 312	50 45"	6 2	187	7 21	1,065
	968C9HE1		9	Rad	G .5625:1	1,475	2,800	890	2,400	13,000	100/130	6 125x6 875	54 95"	6 8	229	7 21	1,390
	972TC18DA1, 2	R3350-34[7]	18	Rad	G .4375:1	3,250	2,900	1,910	2,400	11,400	115/145	6 125x6 312	56 6"	6 7	265	6.46[6]	3,514
	975C18CB1		18	Rad	G .4375:1	2,800	2,900	1,600	2,400	12,500	115/145	6 125x6 312	56 6"	6 7	228	6.46[6]	3,029
	976C9HE1		9	Rad	G .5625:1	1,535	2,800	890	2,400	12,200	100/130	6 125x6 875	55.75"	6 8	236	7.21[4]	1,460

Bmep. — Brake mean effective pressure.
G — Geared.
Ho — Horizontally opposed
Rad — Radial.
SL — Sea level.
Vo — Vertically opposed.

[1] For helicopter installation.
[2] Manufactured under Curtiss-Wright license.
[3] Or 10.14:1.
[4] Or 8.69:1.
[5] Or 8.67:1.

[6] 856TC18DB1 (R3350-30WA) is similar but has takeoff power (wet) of 3,500 hp. and dry gross weight of 3,445 lb. 868TC18DB1 (R3350-85) is similar to -30WA but weighs 3,438 lb. dry. Some have manifold absolute pressure regulator.
[7] Military engine rated at 3,700 hp. max.



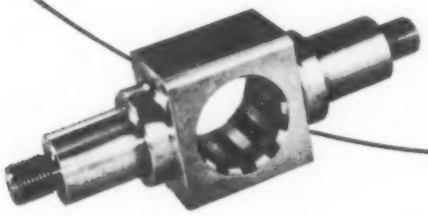
SPECIAL breaks a complex, precision-bottleneck in 'copter rotor assemblies

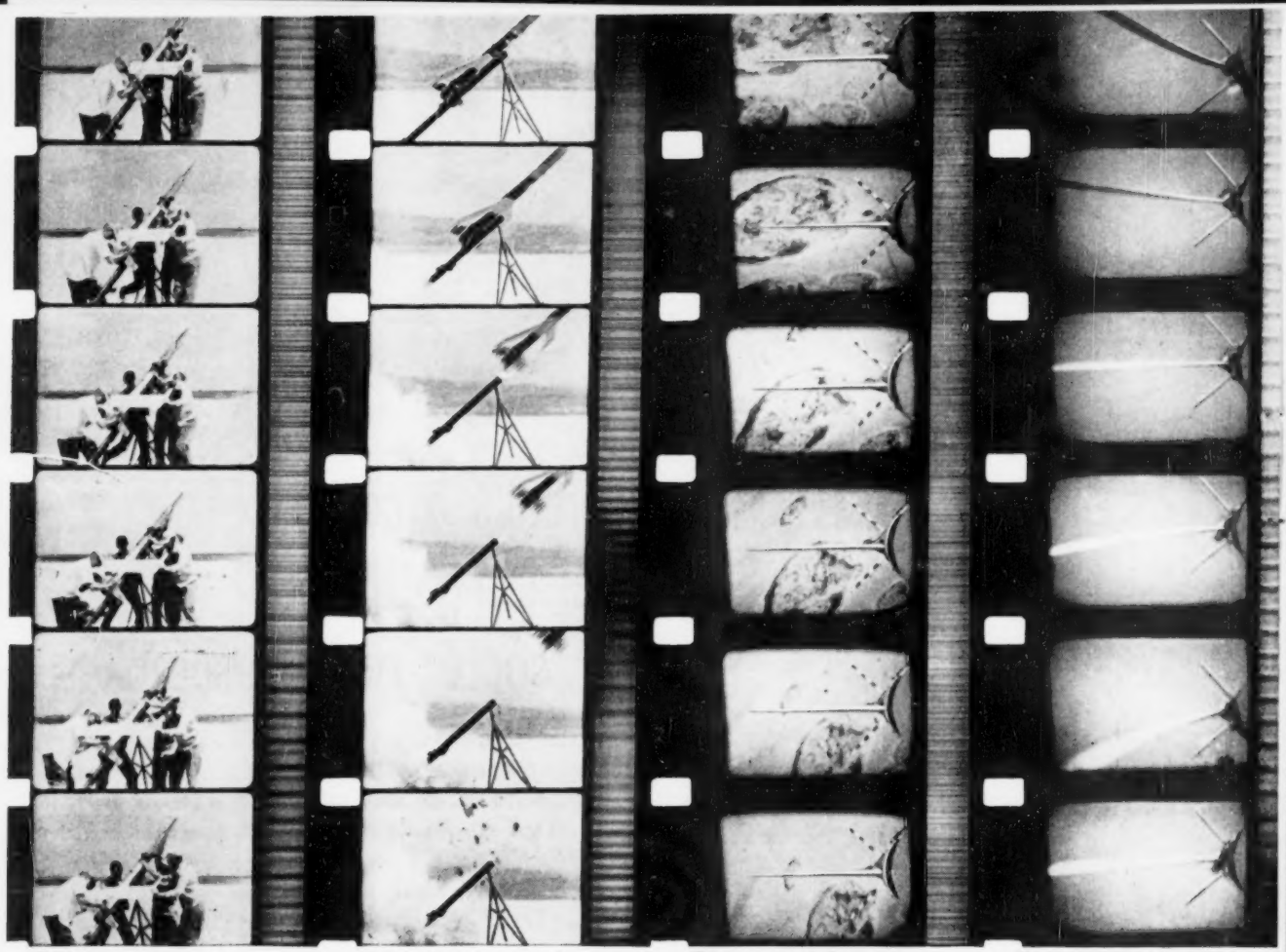
Few companies were willing to undertake this challenge to engineering, tooling, production and quality control. On the 12½" long, 12 lb. hub above, for example, the two buttress threads and adjacent diameters must be held to a concentricity of .001 full indicator reading for a length of 2½ inches. Each component requires more than 40 separate operations. Fine finishes are required throughout, ranging from 20 micro inches to a *maximum* of 100 micro inches.

SPECIAL Machine Tool Engineering Works has been consistently able to produce these vital assembly components *on schedule* despite the close limits and tricky machining involved... And Special's tight quality control standards are maintained at every stage.

That's why many of America's leading aircraft manufacturers and top firms in other industries look on SPECIAL as *a part of their own plants*. Why not find out how SPECIAL can fit into *your* production program?

SPECIAL MACHINE TOOL ENGINEERING WORKS
134 Lafayette St., New York 13, N. Y.
Established 1910





Engineers mount cameras and X-wing on supersonic rocket to test new design.

On California desert, rocket begins flight reaching 3 times the speed of sound.

Desert craters fade away as camera records speed effect on new experimental wing.

Here, another wing design flaps violently from the pressure of the supersonic speed.

Lockheed Scientists Shape the Forms of

Lockheed's Expanding Science Center Improves Today's Planes and Develops New Designs for

FIRST IN THE NATION'S ALL-WEATHER DEFENSE. Lockheed F-94 Starfires are jet interceptors loaded with electronics for almost automatic flight. Starfires protect vital U. S. cities, even in darkness or bad weather. For 8 years, Lockheed has built more jets than any other manufacturer.

Parachuted to earth, rocket camera is recovered with film data vital for the future.

Future Flight

the Era of Automatic Flight

The above film strips take you behind the scenes to show Lockheed scientists testing new wing designs for future aircraft many times faster than today's. This is an example of advanced research at Lockheed's expanding Science Center. Scientist-engineers work with nuclear energy, pilotless aircraft, electronics systems, new metals for the era of automatic flight.

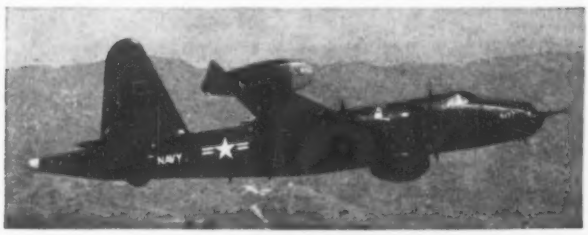
Lockheed discoveries in *pure* science are matched by Lockheed progress in *applied* science. Lockheed's science of design has produced a radar-laden team of protecting military aircraft—flying radar stations, almost automatic interceptors, anti-submarine patrol bombers. Skill in science of production enables Lockheed to produce 12 different models simultaneously—and all models are on schedule!

SCIENCE CENTER—*Future forms of flight are studied here in Lockheed's new Engineering and Science Building.*

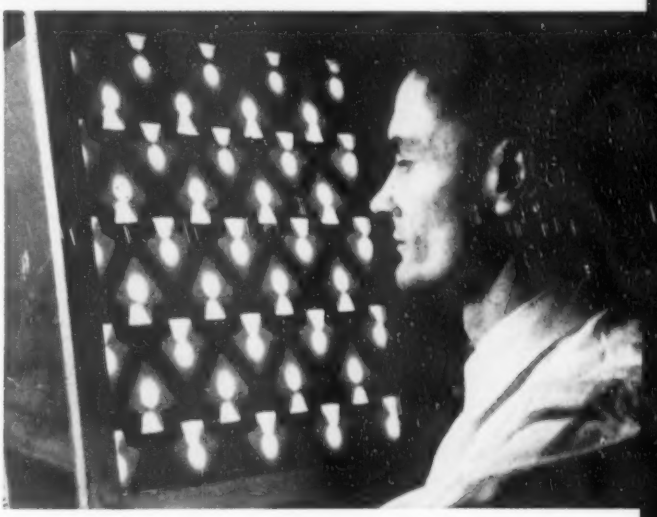
Missiles Era

Lockheed's rapidly-expanding Missile Systems Division is now probing into new, unexplored fields of electronics and pilotless aircraft, integrating 10 years of scientific research into practical application for a top-secret project of vital importance to the U.S. This new Missile Systems Division is adding scientific personnel daily, speeding the conquest of automatic flight through space.

FIRST! FLYING RADAR STATION. Lockheed Super Constellations, with radar humps, provide Navy and U.S.A.F. with new concept of defense—a new method of detecting an enemy hours in advance through applied electronics.



FIRST! ELECTRONIC SUB PATROL—Advanced models of Lockheed P2V Neptune Bombers give U.S. Navy long-range sub patrol with destructive power and advanced sonic devices.



TOMORROW'S METALS. Planes 10 to 25 years from now, currently under study by Lockheed, will require new materials to withstand tri-sonic speeds. Here, Lockheed scientist checks X-ray film of new metal.

COMING SOON—*Look for other dramatic new Lockheed models soon, including XF-104 Day Superiority Fighter.*

Lockheed

California Division—Burbank, California
Georgia Division—Marietta, Georgia
Missile Systems Division—Van Nuys, California
Lockheed Aircraft Service—Burbank, California
Lockheed Air Terminal—Burbank, California

LOOK TO LOCKHEED FOR LEADERSHIP

U.S. Gas Turbine Engines

Manufacturer and Address	Designation	Type	Compressor stages	Turbine stages	No. of combustion chambers	Max. takeoff power @ sea level	Compression ratio @ max. rpm. @ SL	Specific fuel consumption (lb./hr./lb. thrust or eshp.)	Max. length uncowled and minus tailpipe	Max. diameter uncowled and minus tailpipe	Dry weight (lb.) minus tailpipe, cowling and accessories
Allison Division **General Motors Corp.** *Indianapolis, Ind.*	J33-A-16A	CFJ	1	1	14	6,350 lb.t.	4.8:1	1.08	99½"	49"	1,920
	J33-A-35	CFJ	1	1	14	5,400 lb.t.	4.4:1	1.14	107"		1,820
	J35-A-35	AFJ	11	1	8	5,600 lb.t.	5.2:1	1.10	195.5"	43"	2,850
	T40-A-10	AFP	19[1]	4[1]	8[1]	5,850 eshp.	7.3:1	.62	181.5"	38.5	2,565
	T54[2]	AFP				7,500 eshp.*					
	T56	AFP				3,750 eshp.*					
	J71	AFJ				9,500 lb. t.					
Boeing Airplane Co. *Seattle, Wash.*	XT50-BO-1	ACFP	2	2	2	210 shp.	3.2:1	1.3	39.87"	23.2"	267
Fairchild Engine Division **Fairchild Engine & Airplane Corp.** *Farmingdale, L. I., N. Y.*	J44			1	1	1,000 lb.t.*	2.5:1		75.7"	22"	303*
General Electric Co. **Aircraft Gas Turbine Division** *Cincinnati 15, Ohio*	J47-GE-17	AFJ	12	1	8	5,200 lb.t.+			226"	36.75"	3,000*
	J47-GE-19	AFJ	12	1	8	5,200 lb.t.+	5:1	1.03[3]	144"[4]	36.75"	2,500*
	J47-GE-25	AFJ	12	1	8	5,800 lb.t.+			144"[4]	36.75"	2,500*
	J53	AFJ									
	J73	AFJ			1	9,000 lb.t.*			147"[4]		
	J79	AFJ				15,000 lb.t.					
Pratt & Whitney Aircraft Division **United Aircraft Corp.** *East Hartford, Conn.*	J48	CFJ	1	1		7,200 lb.t.+					
	J57	AFJ				10,000 lb.t.*					
	J75	AFJ				15,000 lb.t.*					
	T34	AFP	13	3		5,700 eshp.*		.62*	155*	30"*	2,550*
	T52	AFP				8,300 eshp.*					
Westinghouse Electric Corp. **Aviation Gas Turbine Division** *Philadelphia 13, Pa.*	J34-WE-34	AFJ	11	2	1	3,250 lb.t.	4:1*	1.06	120"	24"	1,233
	J40-WE-6	AFJ				7,200 lb.t.+			180"	40"	3,000*
	J40-WE-8	AFJ				7,200 lb.t.+				40"	3,500*
	J46	AFJ				6,000 lb.t.					
Wright Aeronautical Division **Curtiss-Wright Corp.** *Wood-Ridge, N. J.*	YJ65-W-1	AFJ				7,200 lb.t.					
	J67	AFJ				15,000 lb.t.					
	T47	AFP				12,000 eshp.*					
	T49	AFP				10,000 eshp.*					

* — Approximate.
AFJ — Axial-flow turbojet.
AFP — Axial-flow turboprop.
CFJ — Centrifugal-flow turbojet.
Eshp. — Equivalent shaft horsepower.
Lb.t. — Pounds thrust.

[1] Each power section. T40-A-10 comprises two side-by-side engines using single gearbox.
[2] Advanced version of T40.
[3] At 70% cruise power.
[4] Uncowled, minus tailpipe but with tailcone.

Military Aircraft Appropriations & Expenditures, 1935-1955

Fiscal Year	ARMY AIR CORPS & U. S. FORCE				NAVAL AVIATION				TOTALS	
	Total Approp.[1]	Total Expend.[1]	Airc. Approp.[1]	Airc. Expend.[1]	Total Approp.[1]	Total Expend.[1]	Airc. Approp.[1]	Airc. Expend.[1]	Airc. Oblig. & Approp.[1]	Airc. Expend.[1]
1935	$27.9	$20.3			$32.1	$21.8			$60.0	$42.1
1936	45.6	32.0			40.7	23.0			86.3	55.0
1937	59.6	41.1			38.6	26.5			97.2	67.6
1938	58.9	50.9			51.5	60.8			110.4	111.7
1939	71.1	83.2			48.1	47.5			119.2	130.7
1940	186.6	108.2			111.5	49.5			298.1	157.7
1941	2,173.6	605.4			452.3	190.7			2,625.9	796.1
1942	23,049.9	2,554.9			6,189.4	1,062.5			29,239.3	3,617.4
1943	11,317.4	9,391.9			5,258.0	3,847.3			16,575.4	13,239.2
1944	23,656.0	13,087.3			4,583.7	4,490.1			28,239.7	17,577.4
1945	1,610.7	11,357.4			4,600.6	5,130.0			6,211.3	16,487.4
1946	5,420.5	8,775.8	$393.2	$240.0	922.4	N. A.	$91.3	N. A.	484.5	240.0[5]
1947	3,144.4	2,993.0	477.5	370.7	805.7	752.4	307.9	$259.8	785.4	630.5
1948	3,634.4	3,011.2	1,641.6	630.6	749.0	735.1	329.2	108.6	1,970.8	739.2
1949	3,399.8	3,613.3	731.2	601.6	1,338.0	875.0	738.7	312.8	1,469.9	914.4
1950	4,729.5	3,402.2	1,656.9	1,269.1	1,068.4	939.3	663.0	440.0[5]	2,319.9	1,709.1
1951	16,699	6,381	8,114	1,939	4,387	1,031	3,451	588	11,565	2,527
1952	22,726	12,386	11,882	4,000	5,258	1,980	4,333	1,200	16,215	5,200
1953	22,333	15,512	12,685	6,000	4,873	2,500	3,910	1,610	16,590	7,610
1954[6]	11,416	15,461	3,495	6,900	2,322	3,300	1,319	2,400	4,976	9,300
1955	11,206	16,194	2,760[3]	6,700	2,958	3,400	1,997	2,450	4,747[3]	9,100

[1] In millions of dollars.
[2] Air Force only.
[3] $142 million withheld by the Secretary of Defense.
[4] Estimated on basis of federal budget submitted to Congress.
[5] Plus $1.8 billion in unobligated 1954 funds.
Sources: USAF, U. S. Navy.

from **Research** *through* **Production**

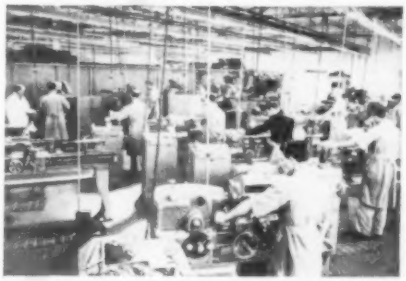
Part of the Rhodes Lewis Engineering and Design Department.

Rhodes Lewis Company, a wholly-owned subsidiary of McCulloch Motors Corporation of Los Angeles, designs and produces specialized types of precision-made pneumatic and electro-mechanical accessories for the military and for aircraft industries throughout the world.

But its capacities are not limited to these fields!

To meet constantly changing requirements, Rhodes Lewis maintains a sound, versatile facility—with equipment and personnel which are readily adaptable to the specialized development and manufacture of similar equipment for other industries.

As an integral part of its designing and manufacturing service, Rhodes Lewis is also equipped to supply operational, overhaul and technical data, and to operate product training schools.



The experimental machine shop where prototypes are made.

The Rhodes Lewis Engineering Test and Development Laboratory.

Some of the precision-made products which Rhodes Lewis has developed, designed and manufactured:

PNEUMATIC SYSTEM COMPONENTS INCLUDING COMPRESSORS

AIR STORE EJECTION AND RELEASE MECHANISMS

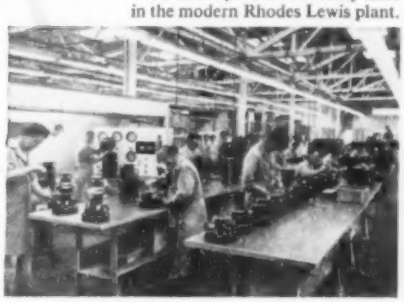
ACCESSORY DRIVES—AC, DC, HYDRAULIC AND LOW PRESSURE PNEUMATIC

ANTI-SUBMARINE WARFARE SYSTEM COMPONENTS

SPECIALIZED AIRCRAFT ELECTRICAL JUNCTION BOXES

We invite your inquiries and suggest personal inspection of our modern plant and facilities. Our competent staff of engineers is available for immediate consultation.

One of the product assembly lines in the modern Rhodes Lewis plant.



RHODES LEWIS CO., *a subsidiary of*
McCULLOCH MOTORS CORPORATION

LOS ANGELES 45, CALIFORNIA

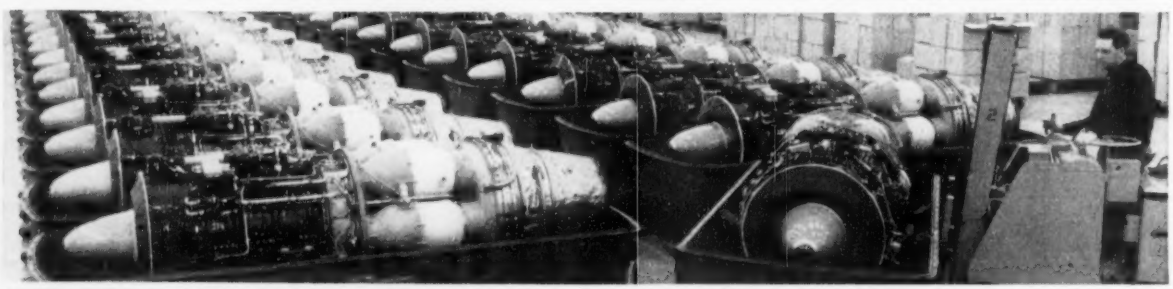
7-3304

Leading Foreign Jet Engines

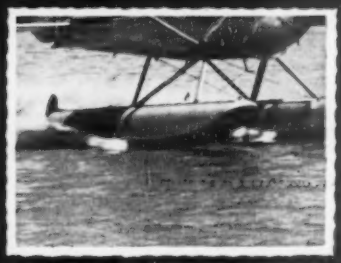
Manufacturer and Address	Designation	Type	Compressor stages	Turbine stages	No. of combustion chambers	Max. takeoff power @ sea level	Compression ratio @ max. rpm. @ SL	Specific fuel consumption (lb./hr./lb. thrust or eshp.)	Max. length uncowled and minus ta ilpipe	Max. diameter uncowled and minus tailpipe	Dry weight (lb.) minus tailpipe, cowling and accessories
AUSTRALIA											
Commonwealth Aircraft Corp. Pty., Ltd. *Port Melbourne*	Nene 2-VH	CFJ	1	1	9	5,000 lb.t.	4:1	1.0	104"	49.5"	1,610
	Avon Mk. 1	AFJ	12	2	8	6,500 lb.t.	6:1	.89	126.6"	42.4"	2,258
CANADA											
A. V. Roe Canada Ltd. *Malton, Ont.*	Orenda 8	AFJ	10	1	6	7,500 lb.t.	.....	.....	121.46"	42"	2,700*
	Orenda 9	AFJ	10	1	6	.....	.....	.....	121"	45"	2,685
	Orenda 10	AFJ	10	1	6	.....	.....	.....	123"	44.6"	2,700
	Orenda 11	AFJ	10	2	6	.....	.....	.....	121"	45"	2,590
GREAT BRITAIN											
Armstrong Siddeley Motors Ltd. *Parkside, Coventry*	Mamba ASM.3	AFP	10	2	6	1,475 eshp.	5.35:1	.80	57.83"	29"	780
	Double Mamba ASMD.1	AFP	10	2	6 ea.	2,950 eshp.	5.35:1	.80	79.83"	52.8"	2,100
	Python Mk.3	AFP	14	2	11	4,110 eshp.	5.35:1	.80	120"	54"	3,450
	Sapphire ASSa.6	AFJ	12	2	.....	8,300 lb.t.	.....	.90	106"	35"	2,500
	Viper ASV.3	AFJ	.....	.....	.....	1,640 lb.t.	.....	.....	45.4"	23.3"	365
	Viper ASV. 5[1]	AFJ	.....	.....	.....	1,640 lb. t.	.....	.....	.....	23.3"	465
Bristol Aeroplane Co., Ltd. *Filton, Bristol*	Proteus 705	ACFP	12A, 1C	4	8	3,780 eshp.	.....	.48	100.6"	39.5"	2,650
	Proteus 755	ACFP	12A, 1C	4	8	4,150 eshp.	.....	.49	100"	39.5"	2,925
	Olympus BO1.	AFJ	.....	.....	.....	9,750 lb. t.	.....	.....	124"	40"	3,520
	Orpheus	AFJ	.....	.....	.....	.....	.....	.....	.....	.....	.....
de Havilland Engine Co., Ltd. *Stonegrove, Edgeware, Middlesex*	Goblin 35	CFJ	1	1	16	3,500 lb.t.	3.4:1	1.14	60"	50"	1,619
	Ghost 48 Mk. 1	CFJ	1	1	10	4,850 lb.t.	4:1	1.17	115.5"	53"	2,174
	Ghost 50	CFJ	1	1	10	5,000 lb.t	4:1	1.06	115.5"	52"	2,174
	Gyron	.....	.....	.....	.....	15,000 lb. t.*	.....	.....	.....	.....	.....
D. Napier & Son Ltd. *London W. 3*	Nomad 2	AFP	12	3	.....	3,046[2]	.....	355	109.5"	58.5"	3,580
	Eland	AFP	10	3	6	3,000 eshp.	.....	.624	140.5	36"*	1,575
Rolls-Royce Ltd. *Derby*	Derwent R. D. 7	CFJ	1	1	9	3,600	4:1	1.03	83.1"	43"	1,280
	Nene R.N.2	CFJ	1	1	9	5,100 lb.t.	4.5:1	1.06	96.8"	49.5"	1,631
	Dart Mk. 505	CFP	2	2	.....	1,400 eshp *	5.5:1	.83	95"	38"	1,030
	Avon R.A.2	AFJ	12	2	8	6,000 lb.t.	.....	.98	130.25"	41.5"	2,402
	Avon R. A. 3	AFJ	12	2	8	6,500 lb. t.	.....	.88	102.1"	42.2"	2,240*
	Avon R. A. 7	AFJ	12	2	8	7,500 lb. t.	.....	.92	102.1"	42.2"	2,460*
	Avon R. A. 7R[4]	AFJ	12	2	8	9,500 lb. t.	.....	1.90[5]	117.5"	42.2"	2,960*
	Avon R. A. 9	AFJ	12	2	8	7,000 lb. t.	.....	.91	102.6"	42.2"	2,440
	Avon R. A. 14	AFJ	12	2	8	9,500 lb. t.	.....	.84	113.3"	41.5"	2,860
	Avon R. A. 16	AFJ	12	2	8	9,000 lb. t.	.....	.83	113.3"	41.5"	2,710
	Avon R. A. 21	AFJ	12	2	8	8,000 lb. t.	.....	.92	102.1"	42.2"	2,460
	Avon R. A. 22	AFJ	12	2	8	7,150 lb. t.	.....	.89	102.6"	42.2"	2,242*
	Conway R.Co.2	.....	.....	.....	.....	10,000 lb.t.	.....	.....	.....	.....	.....
FRANCE											
Societe d'Exploitation des Materials Hispano-Suiza *Bois Colombes (Seine)*	Nene	CFJ	1	1	9	5,066 lb.t	4:1	1.04	93"	48"	1,608
	Verdon R-450	.....	.....	.....	.....	7,720 lb. t.	.....	1.07	.....	.....	2,015
Societe Rateau *La Courneuve (Seine)*	SRA 101	AFJ	10	2	12	7,275 lb.t.	6:8	.86	121"	43"	2,288
Societe Nationale d'Etude de Constructions de Moteur d'Aviation *Paris*	Atar 101C	AFJ	7	1	.....	6,160 lb.t.	4.5:1	1.0	112"	34.9"	1,950
	Vulcain	AFJ	.....	.....	.....	10,000 b. t.	.....	.....	.....	45.6"	3,080
Societe Turbomeca *Paris*	Artouste	CFP	1	1	.....	280 eshp.	.....	.88	31.4"	21.4"	185
	Aspin 2[6]	CFJ	1	2	.....	792 lb. t.	.....	.55	47.5"	23.6"	320
	Marbore 2	CFJ	1	1	.....	880 lb. t.	3.9:1	1.15	52.4"	22.3"	286
	Palas	CFJ	1	1	.....	352 lb.t.	.....	1.22	41.5"	16"	132
	Pimene	CFJ	1	1	.....	242 lb.t.	3.8:1	1.05	41.5"	16"	118

* — Approximate.
AFJ — Axial-flow turbojet.
ACFP — Combination axial-and-centrifugal-flow turboprop.
AFP — Axial-flow turboprop.
CFJ — Centrifugal-flow turbojet.
CFP — Centrifugal-flow turboprop.
Eshp. — Equivalent shaft horsepower.
Lb.t. — Pounds thrust.

[1] Long-life piloted aircraft version of ASV. 3.
[2] Lightweight, medium-thrust unit for Folland Gnat fighter.
A 12-cylinder horizontally opposed compression-ignition engine supercharged by an axial-flow compressor and coupled to an exhaust gas turbine. Power from the C.I. engine and excess power from the turbine are absorbed by a single-rotation propeller.
[4] Fitted with afterburner.
[5] Using the afterburner.
[6] Ducted fan.



AVRO ORENDA axial-flow turbojets in the 8,000-lb.-thrust category, lined up for delivery from the Malton, Ontario plant.

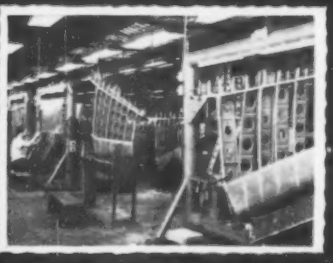


EDO FLOATS, famed since 1925, today as then set the standard for fine performance and rugged reliability all over the world.

EDO DEPTH SOUNDERS, now in wide use on Naval vessels, have helped make Edo the recognized leader in sonar design.

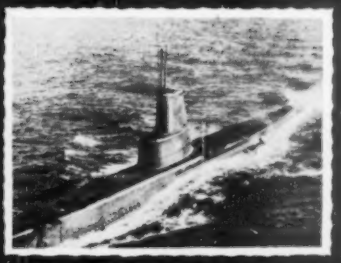
RESEARCH. Edo's staff of scientists and engineers, experienced in many fields, is undertaking a variety of research projects.

COMPONENTS. Edo builds fins and rudders for F-84 Thunderjets; also builds external stores housing for electronic equipment.



PRODUCTION. Edo proficiency is carried through from original design to volume production. A production line is shown above.

HYDROSKI. Edo initiated basic development and conducted extensive flight test evaluation of the new and revolutionary Hydroski.



PERISCOPE FAIRINGS designed by Edo streamline submarine periscopes and eliminate tell-tale plume, former sub giveaway.

NEW HULL SHAPES, built, flight tested and evaluated by Edo, have contributed much to the improved performance of flying boats.

DEVELOPMENT from initial conception to completed design is unique Edo ability. Example: the Edo OSE scout observation plane.

Edo's Picture Album of ***DIVERSITY*** . . .

. . . *the Result of* ***PERFECTION***

Only a brief glimpse into the vast scope of Edo's diversified activities is afforded by these pictures.

Such outstanding talent in so many fields amazes all — especially those who have known Edo for over a quarter of a century as designers and builders of the world's finest seaplane floats.

In the broad fields of aviation, marine and electronics, Edo has made and is making many outstanding contributions. Yet, as diversified as Edo's operations are, ONE fact stands out. Edo can take an idea, translate it into a superior product, device or system, and then *build* it.

EDO CORPORATION COLLEGE POINT, L. I., N. Y. Since 1925

G.E. DEVELOPS 400-AMPERE GENERATOR TO MEET NEEDS OF NATION'S AIRLINES

A compact new 400-ampere generator requiring only six inches of cooling air over a range of 4500-7000 rpm has been developed by General Electric to meet the needs of the nation's airlines.

First application of the new d-c generator is on the Douglas DC-7. All electric power aboard America's newest airliner is supplied by four of the new 30-volt, 400-amp G-E generators.

The new generator (Model 2CM244) has the highest capacity of any wide-speed-range commercial unit of its size (6½-inch frame). Resulting from G.E.'s continuous interest in the requirements of commercial airlines, the new equipment offers these *exclusive* features:

- QUICK-ATTACH-DETACH (QAD) mounting flange permits installation in minutes instead of hours.
- CLEARANCE-TYPE SHAFT absorbs engine drive vibrations and reduces spline wear to insure longer life and reduced maintenance.
- SHRINK-RING COMMUTATOR permits higher speeds without commutator distortion to provide greater service life.
- NEW CORED BRUSH, a distinct advance in aircraft brush design, eliminates pre-filming of commutator, improves commutation, and reduces commutator temperature.

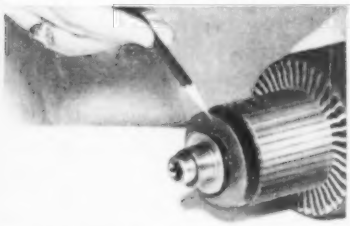
The new aircraft generator also offers these improvements:

1. Silver-plated, cast-bronze brush holder minimizes brush chatter and increases contact efficiency.
2. Solid-steel armature binding bands securely hold end turns and prevent winding distortions.
3. Pre-lubricated clearance-type shaft (internally lubricated) provides for increased operating life.

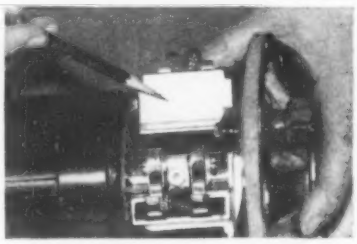
Whether your requirement is a-c or d-c, a single generator, or complete electrical systems, contact your General Electric aviation specialist, or write Section 210-85, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC

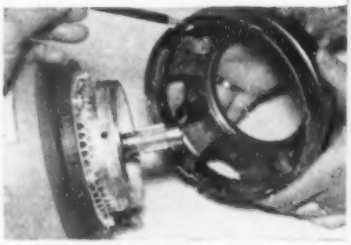
Exclusive features of new G-E generator on DC-7



SHRINK-RING COMMUTATOR withstands higher speeds without distortion to insure long service life.



CORED BRUSH eliminates pre-filming of commutator, improves commutation and reduces commutator temperature.



QUICK-ATTACH-DETACH mounting flange sharply reduces time required for generator removal or installation.

Airpower Balances on Budget Tightrope

Lean U.K. treasury forces government to hold down defense procurement, push export sales of military and civil aircraft. RAF receives first squadron of Swift F-1s, as B-47s and F-86s still man front lines.

HAWKER HUNTER

By Nat McKitterick

(McGraw-Hill World News)

London—The breathing space in the East-West conflict which Sir Winston Churchill predicted more than a year ago has been a great boon to British aviation.

It has allowed Britain to follow a two-pronged policy on airpower development, compatible with the precarious living this country ekes out these days.

On the one hand, procurement of new aircraft for the Royal Air Force has been kept down—only $392 million in fiscal 1953-54 and not much more in the up-coming year. Britain's air chiefs have deliberately postponed placing large orders for aircraft which promise to show marked improvement with more time.

On the other hand, a sizable proportion of Britain's airpower buildup has been turned into a commercial asset. Makers of Britain's famed civil jet transports have official priority equal to the most important military aircraft projects. And exports of both civil and military aircraft are booming. Last year the British exported about $182-million worth of aircraft, split almost 50-50 between civil and military types. At the same time, about $56-million worth of civil aircraft were delivered to British Overseas Airways Corp., British European Airways and to the small fleets of Britain's private operators.

While these figures don't accurately describe the division of labor between military and civil work in the U.K. industry, it is significant that over half the value of completed aircraft delivered last year was paid for by customers other than the RAF.

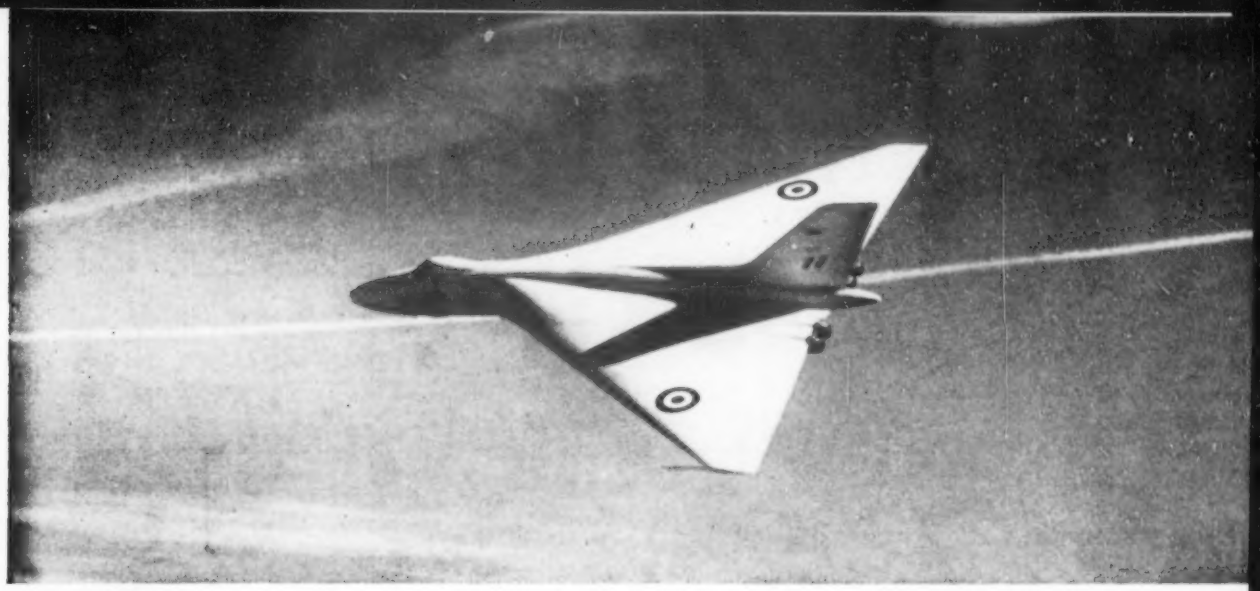
►**Good Economics, Poor Defense**—If this is satisfactory economics, nobody here claims it to be satisfactory defense. The front line of defense in the U.K. today is still manned by USAF-flown B-47 Stratojets and Canadair-built F-86 Sabres given to RAF Fighter Command over the past two years.

Military Aviation

Not until recent weeks has RAF received its first home-built sweptwing fighter squadron—Supermarine Swift F.1s. And despite the expected delivery of a small number of Vickers Valiant four-jet medium bombers this year, Britain's very promising strategic air arm won't exist in significant numbers before 1956.

The ultimate targets of the RAF, as set out three years ago when the current rearmament program was started, are still a long way away. When announcing the program, the then Labor government's Air Minister, Ar-

GLOSTER JAVELIN



AVRO VULCAN

thur Henderson, predicted that in fiscal 1954-55, for the first time, the RAF would outstrip the other British services in its claim on the annual defense budget.

But last year's defense cutbacks upset Henderson's prediction. This year's defense budget, which will be announced about the time this is printed, will again show the British Army getting more money than the RAF, and the British Navy not far behind.

▶**Envy U.S. "New Look"**—Understandably, British airmen are not a little envious of the "new look" in U.S. defense policy which clearly establishes the USAF's prior claim on defense funds. Virtually all the arguments that led to the U.S. policy shift have been used here by air-minded British strategists for a long time.

Like the Pentagon, British military planners see the best defense against Russia today in terms of instant and devastating retaliation. Put another way, the British don't yet see any reliable technical defense against enemy missile strikes from the air. In World War II, 1,050 missiles—German V-1s and V-2s—fell on England. Now, almost 10 years later, the RAF would again have to rely on bombing launching sites as the major means of countering even these first products of the missile age.

At the same time, Churchill, like President Eisenhower, is under the strongest sort of political pressure to keep defense spending within bounds. Indeed, only a Churchill could risk trotting out a budget this year that earmarks just a bit more for defense than last year's budget did. The increase reflected in this year's defense budget unfortunately does not stem from new spending on air development. It was made inevitable by Britain's irreducible commitments overseas.

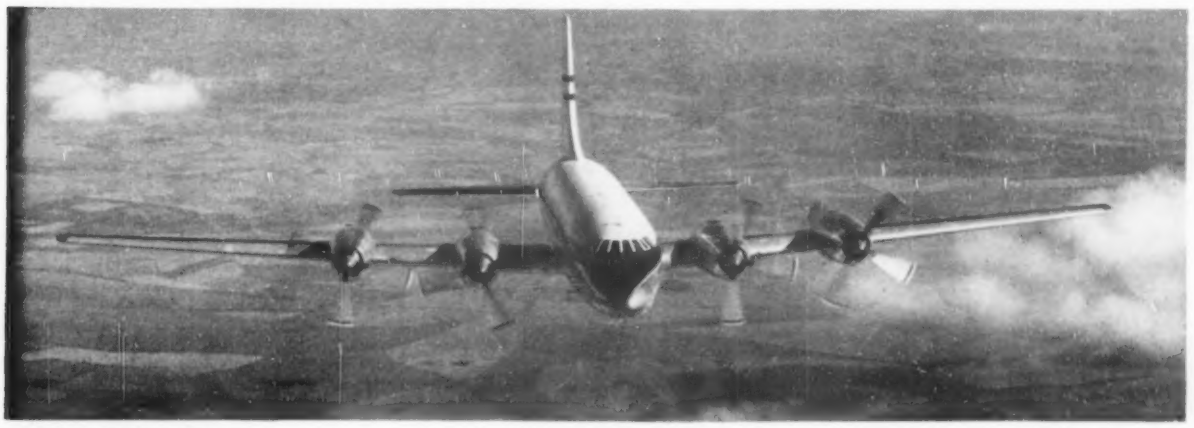
Like the U. S., the British would dearly love to effect these economies by reducing their troop commitments overseas.

In the words of Earl Alexander of Tunis, Churchill's Defense Minister, "My aim is to build up a strategic reserve (in the U.K.) ready to go off to deal with any emergency at any time." Alexander spoke one month after President Eisenhower said virtually the same thing in the U.S.

▶**Overseas Troops**—Reducing troop commitments overseas is far more critical to the development of the RAF than it is to development of USAF.

Today Britain has 15,000 troops in Malaya, 80,000 more in Suez, about two divisions in Kenya, four armored divisions in Germany, and smaller garrisons in such farflung places as British Guiana, Gibraltar and Hong Kong. For a nation which is stretching its economic capabilities to find $4.6 billion a year to spend on all defense needs, these commitments mean an enormous maintenance budget. In fact they mean that the British Army needs and gets more money than the RAF.

▶**Research Suffers**—These troop commit-



BRISTOL BRITANNIA

Approved by Boeing for the

B·47

1¼" valve here meets all specifications and qualifying tests for use on Boeing B-47

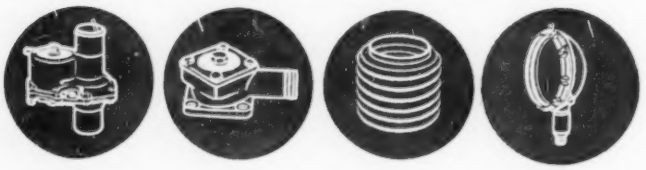
Standard-Thomson

Shut-Off Valves

● For positive, unfailing shut-off control of fuel, hydraulic oil, etc., specify Standard-Thomson motorized valves—with *three* key advantages: (1) soft, synthetic rubber seals—mechanically retracted during the valve cycle to lessen wear, lengthen life; (2) positive gate positioning, assured by mechanical override which disengages gate in full open or closed position; (3) simple, one-directional actuator—saves on cost and complications. In production: 1" to 3" sizes. Easily adapted for other mediums and capacities. Get the facts. Submit specifications or requirements to:

STANDARD-THOMSON CORPORATION • DAYTON 2, OHIO

Makers of USAF-approved bellows • valves • lights



Crankcase Pressurizing Valve | Barometric Pressure Valves | Tech-Forge Flexible Couplings | Vaporproof Cabin Lamp

■ BRITAIN

ments put a low ceiling on aircraft procurement for the RAF. More serious, they curtail spending on military research. No research figures as such are printed in Britain's defense budget, but the late Chester Milmot, Britain's leading writer on military affairs (who died in the Comet crash last January), claimed that less than 10% of last year's defense budget was spent on research. Wilmot figured "only a small proportion" of that 10% was spent on guided missiles.

This year spending will be shifted a little in the RAF's favor—and in the favor of research. But until some of Britain's overseas commitments are liquidated, in one form or other, the RAF's plans will continue to be hamstrung for lack of funds. The issue rests with Britain's diplomats and with the U.S. It is almost certain that the British will follow any U.S. lead in withdrawing troops from such places as Germany and Korea.

▶ **U.S. Aid**—While RAF development is held in check by Britain's overseas commitments, it is also supported to a crucial extent by U.S. aid.

Lockheed Neptunes, Douglas Skyraiders, and North American-Canadair Sabres have been given to the RAF and to the Royal Navy. (Many of the Sabres, incidentally, are grounded in the U.K. for lack of a spares backlog; others are in Germany.)

More important, some $482 million in U.S. money has been earmarked for direct financial help to the British aircraft industry over the past few years. That is a third again more than last year's total RAF budget for the procurement of new aircraft and engines. In one way or another, the RAF's whole production schedule is geared to this aid.

The U.S. has given the U.K. $112 million in machine tools, without which the rather spectacular production program for the Rolls-Royce family of Avon jet engines would not have been possible. U.S. tools, the last of which are only now being delivered, are helping to turn out Avons in five different factories. In a sixth factory, they are helping turn out Armstrong Siddeley Sapphire jets.

Then there is the "offshore" purchase program which has benefited Britain more than any other NATO power. So far, the U.S. has ordered $147-million worth of Hawker Hunter F.1s in the U.K. and $117-million worth of Hunters in Holland (airframes) and Belgium (Rolls-Royce R.A. 7 engines). To replace a shipment of Douglas Skyraiders slated for the British but diverted, the U.S. last year spent $13 million on Hawker Sea Hawk jets (Rolls-Royce Nene), now in squadron

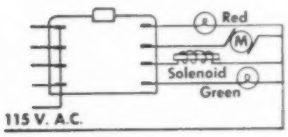
Announcing...

- **THE ONLY DOUBLE POLE SWITCH WITH EIGHT CONTACTS.** Makes possible a wide variety of circuit combinations.
- **THE ONLY DOUBLE-POLE SWITCH WITH SIMULTANEOUS "MAKE" AND "BREAK" ACTION.** Reduces arcing, prolongs switch life, increases electrical capacity and permits unusual applications.
- **THE SMALLEST DOUBLE-POLE SWITCH.** Saves weight and space; allows more compact designs.

the new ELECTRO SNAP SIMULTANEOUS DOUBLE-POLE SWITCH

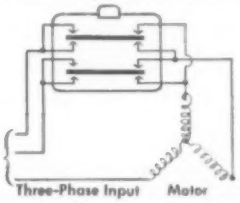
Look What You Can Do With It...

Control Four Circuits with ONE Snap



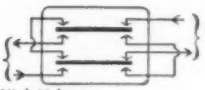
Used in motor control device at left, switch, when actuated, (1) turns off red pilot light; (2) completes circuit to motor winding, starting motor; (3) opens circuit to solenoid latch; locking door to motor gear box; and (4) turns on green pilot light.

Start, Stop, Reverse Three-Phase Motors



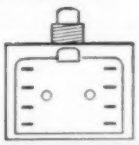
Because this new double-pole switch can simultaneously break or reverse current flow through *two* windings of a three-phase motor, you can use it as an inexpensive limit switch on three-phase lathes and drills. Use it to control automatic sequences, to limit motion of machine members driven by three-phase motors and as a start-and-stop switch.

Wire Movable Poles in Series to Switch High Current or High Voltage



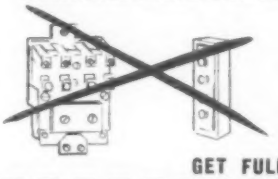
As proof of simultaneous action, you can connect the two movable poles in series to increase contact area for high current applications and to increase number of contact breaks for high voltage switching.

Equip with Actuator



Push-button actuator may be added for panel mounting or for long overtravel. Switch is rated at 15 amps 125/250 v. AC or 10 amps inductive, 30 v. DC. Case dimensions are only 1½" x ⅞" x ½". Weighs only 20 grams.

Eliminate Expensive Relays and Additional Switches in Many Applications



This double-pole switch offers designers a wide variety of circuit hook-ups that were formerly possible only with complicated relays or a number of separate switches. Controlling three-phase motors is but one example.

OTHER ELECTRO-SNAP PRECISION SWITCHES

Standard Basic Switch · Sub-Miniature Basic Switch · Immersion-Proof Switch · Industrial Limit Switches · Hermetically-Sealed Switches

GET FULL DATA

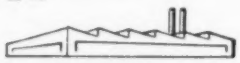
ELECTRO-SNAP SWITCH AND MFG. COMPANY
4216 West Lake Street DA-3
Chicago 24, Illinois

Please send full information about the new Electro-Snap Double-Pole Switch to:

Name_____
Title_____
Company_____
Street_____
City_____ Zone____ State_____

Functional Design

an ADVANCE RELAY for every application



INDUSTRIAL...

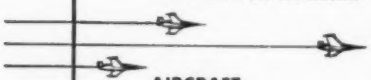
Unsurpassed relays for commercial and industrial applications. Advance can meet all requirements. They offer a complete line of rugged precision-built relays for your specific needs.

COMMUNICATIONS...

Designed for demands of minimum cost, compactness and dependability, Advance Communication Relays should be the number one choice for your valuable equipment. Each Advance Relay *must* and *does* meet the highest standards of precision and quality.

ELECTRONIC...

Engineered to meet the most exacting requirements of delicate electronic equipment, Advance provides a large selection of highly accurate relays—meeting demands of longevity, and critical environment.



AIRCRAFT...

Advance offers a complete line of AN approved, quality engineered relays for aircraft. They meet or surpass all Military and Civilian requirements. All are lightweight, compact and rugged. Some models available hermetically-sealed.

ADVANCE RELAYS

ADVANCE ELECTRIC & RELAY COMPANY

2435 NORTH NAOMI ST. • BURBANK, CALIFORNIA

BRITISH CIVIL AIRCRAFT BUILT FOR HOME AND EXPORT SINCE THE WAR

Type	No.	Supplied to:
Handley Page Hermes 4	25	BOAC.
Airspeed Ambassador	21	BEA.
Vickers Viking	69	BEA. (only 41 now on strength—rest sold to operators in UK and abroad).
" "	75	Various operators overseas, including Egypt (7), Rhodesia (9), B.W.I. (6), India (12) Iraq (4).
Handley Page Marathon	3	Burma
" "	6	W. Africa
De Havilland Heron[1]	1	Isle of Jersey
" "	14	Indonesia
" "	3	Japan
" "	2	Norway
" "	4	New Zealand
" "	9	UAT (France)
" "	4	Uruguay
" "	2	Brazil
Percival Prince	2	Tanganyika
" "	2	Venezuela
" "	1	Switzerland
Short Sealand	1	Pakistan
" "	1	Egypt
" "	2	Norway
" "	6	Finland
" "	1	Borneo
" "	1	Dutch New Guinea
" "	2	E. Bengal
Avro Tudor 4	21	BSAA
" " 5	6	BSAA
De Havilland Dove	Over 500 to some 40 countries, including: Australia, Burma, Brazil, Argentina, Canada, India, Japan, (4), New Zealand, Sudan, Africa, U.S. (over 50).	
Bristol Freighter	180	Canada, Australia, New Zealand, France, Spain, Saudi-Arabia, West Africa, Indo-China.
De Havilland Comet 1	9	BOAC
" " 1A	10	Operators overseas.
" " 2	12	BOAC
" " 3	3	PAA
" " 3	5	BOAC
" " 3	2	India
Bristol Britannia	31	BOAC
" "	6	Qantas (Australia)
Vickers Viscount	41	UK
" "	47	Operators overseas.
Auster Lightplanes	Many hundreds	All parts of world.

[1] Total Herons on order in December 1953: 42.

service with the Royal Navy.

▶ **More Help Sought**—Last August, the British approached Washington with a further request. They asked for a financial grant of some $210 million, spread over two years, to make good the production commitments they have already made to NATO defense planners. At this writing, a decision from Washington is imminent. If the request is granted (and there is opposition in the Pentagon), much of the money will be administered as further "offshore purchases" of Hunters or Gloster Javelin delta-wing all-weather fighters.

Despite stories to the contrary, no decision has been made as to who will finally get the "offshore" Hunters produced in the U.K. The U.S. takes legal title to the aircraft when they come off the production line in June 1955, or thereabout. Then the U.S. may allocate them anywhere.

Trying to plan ahead for RAF Fighter Command, the British are anxious to have a decision soon. It is certain that they will get some of the aircraft, if not all of them. This, of course, makes the whole "offshore" business equal a financial grant, something U.S. officials are afraid Congress will object to. But the fact is that its object is to increase Britain's defense contribution, and to that end the RAF needs many Hunters.

The Norwegians want Hunters and may get a few from this source. But only one other country could absorb any large numbers. That is Germany.

The idea of using Hunters to form the nucleus of a German air force is very much alive. The British were led to believe that many of the original Hunters ordered "offshore" in the U.K. would go to Germany. But the whole timing of German rearmament has been put back since then.

▶ **What Our Money Buys**—Is this investment a good one?

Chances are this question is going to be faced pretty directly in Washington this year. Opponents of spending money on European aircraft production are likely to stress two points:

• **Aircraft factories in Britain,** as well as on the Continent, are vulnerable to Russian air attack. This argument is sure to be used this year as NATO tackles its top-priority air decision: the picking of a NATO all-weather fighter. The question resolves itself on a choice between the Gloster Javelin and the F-86K. The British argue that it would be cheaper for the U.S. to finance a second Javelin production line in the U.K. to supply NATO nations. They point to the huge expense involved now in assembling F-86Ks at Fiat in Italy.

But other, more telling, political reasons make it highly likely that the U.S. will support the F-86K. Congress is likely to look more fondly on the offshore program if at least one U.S. aircraft is involved. And in Italy politics dictate keeping the Italian aircraft production force intact if possible. Right now Fiat has a small contract to assemble 50 North American-built F-86Ks. Chances are it will be followed with a large contract to build the aircraft completely at Fiat for NATO.

• **One possible interpretation** of the new U.S. defense policy would allocate to America's allies the primary job of policing world trouble areas on the ground. The strategic punch and the mobile reserve would come from the U.S. In this context is it sound to build up European airpower?

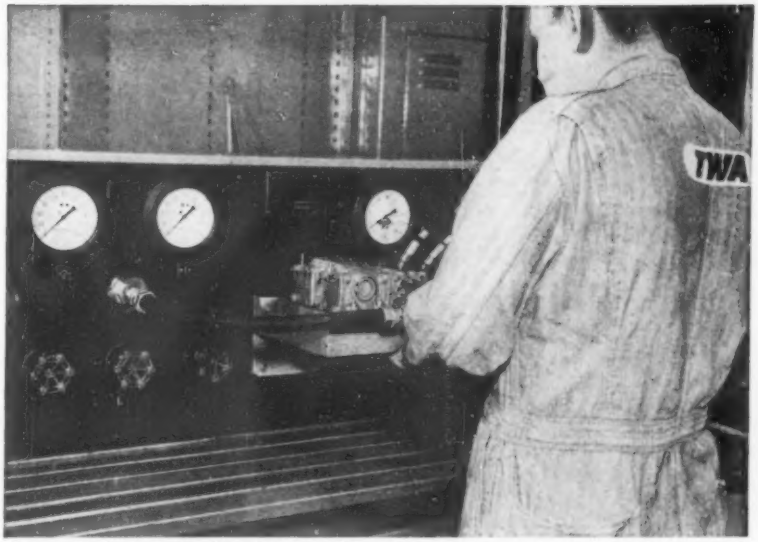
Either of these arguments, or both, taken very far could cripple the hopes of the RAF, now so dependent on U.S. aid. But both the practice and promise of British military aviation today make it extremely unlikely that the U.S. will change its policy here.

First, the fact that the largest aircraft production base in the West, outside the U.S., exists and is producing in Britain today argues strongly that our investment is a good one.

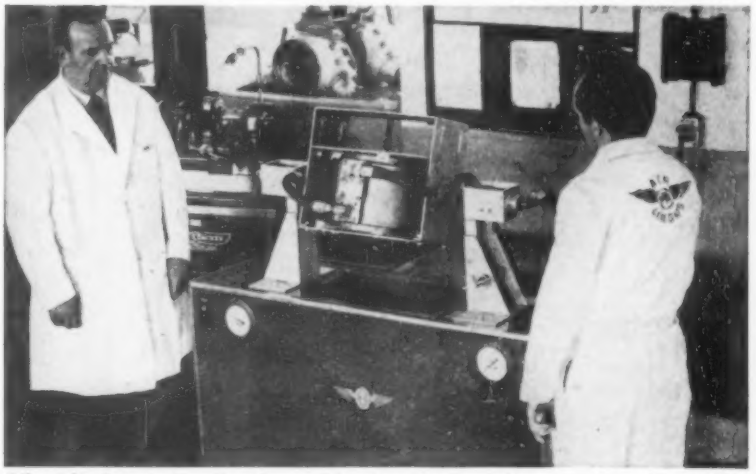
Second, the proven inventiveness of Britain in aviation matters promises many original contributions to Western defense in the months to come.

Production

In many ways British aircraft produc-



Thermostatic control valve, shown under test by TWA technician, controls oil supply to oil cooler. Greer's Oil Radiator Temperature Control Valve Test Stand checks its performance and dependability under low, normal and high temperatures. Same machine also tests controls that operate cowl flaps of reciprocating engines.



Oil cooler being cleaned and tested by Aer Lingus maintenance men. This Greer Oil Cooler Stand sends cleaning fluid through cooler at the rate of two flow reversals per minute. Its tumbling and surging actions insure complete and positive cleaning. A compressed air circuit tests for cooler leaks after cleaning.

IN KANSAS AS IN IRELAND . . .

Greer Units Test Oil Cooling System

Greer precision test equipment has been proved throughout the world to give identical results regardless of place, conditions, or operator.

The standard Greer machines above do a complete test job on aircraft oil cooling systems. They work as a team to check the performance and dependability of the thermostatic control valve and the oil cooler under simulated flight.

Greer has pioneered in the standardization of test stands. Now, most machines can be ordered directly out of a catalog. Call or write for your copy. Greer also designs and builds to meet your exact test and maintenance requirements.

GREER
TEST EQUIPMENT

GREER HYDRAULICS INC., 454 EIGHTEENTH STREET, BROOKLYN 15, NEW YORK
Field Offices in Chicago, Dayton and Detroit • Representatives in principal cities in U. S. and abroad

Output from this rugged Genisco Accelerometer
(GLH MODELS)
is measured in volts ... not millivolts!

minimizes need for amplifying devices!

IMPORTANT GLH PERFORMANCE CHARACTERISTICS

Damping Factor: Instruments up to ±7.5 G's inclusive can be damped .4 to .6 critical; ±7.5 G's to ±10 G incl. .35 to .55 critical; above 10 G's .3 to .5 critical.

Range: ±2 G's to ±30 G's; zero acceleration at midpoint.

Natural Frequencies: 6 to 23 cps. (depending upon range).

Potentiometer Resistance: From 1000 to 10,000.

Resolution: Normally from .25 to .3%, depending upon resistance requirements.

Steady State Acceleration: Can withstand 75 G's in all planes without damage; somewhat less along sensitive axis in low range units.

Linearity: ±0.5% of best straight line through calibration points.

Resistance to shock: 40 G's in any lateral direction; shock loads in 2 directions, equal to range, without damage.

Crosstalk error: Less than 1% change caused by lateral acceleration equivalent to total range of instrument.

Weight: 2 to 2¼ lbs., depending on "G" range.

Overall Physical Size: 3¼"x3⅛"x 2⅝".

Static Friction: .075 G max. up to and including ±7.5 G's.

0.5% full scale output above ±7.5 G's.

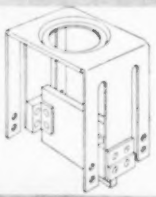
(special modifications for higher natural frequencies and greater damping can be supplied.)

A precision built potentiometer is the secret behind the high output of Genisco's GLH Accelerometer

As much as 50 volts can be put across the potentiometer of the standard GLH, and up to 72 volts on special models. Since the wiper scans the full voltage range, use of the GLH eliminates the need for amplifying devices in many guided missile control and flight test applications.

Keeping the resistance winding free from foreign materials during assembly, careful adjustment of the wiper pressure to precise tolerances, and hermetic sealing of the instrument in inert gas result in electrical output noise so low it can be considered negligible—over a life span in excess of 4 million cycles.

Complete specifications and prices on the GLH are available from Genisco, Inc., 2233 Federal Ave., Los Angeles 64, California. Write today.



A parallelogram suspension confines the mass of the GLH to a virtual straight line motion and provides excellent lateral rigidity.

Genisco
INCORPORATED

Other accelerometer models also available!
Write today for information on Genisco's new GMO miniature potentiometer-type accelerometer (weighs only 7 ounces), the new tapped-potentiometer-type accelerometers, and the new DDL Dual-Damped (oil and magnet) accelerometers. Prompt deliveries on all models.

■ BRITAIN

tion is much maligned without cause.

The Avon engine program is a case in point: Production has been so successful that at present, according to one expert, the supply of Avons is almost twice the availability of airframes. There is no engine shortage in the U. K.

The group of companies making the English Electric Canberra (English Electric, A. V. Roe, Ltd., Short Bros., and Handley Page) have delivered upwards of 400 to the RAF so far—the biggest single aircraft production effort in the world outside of the U. S. and Russia. This light bomber has proved itself able to run away from Sabres at altitude in mock combat.

The end of Canberra production is in sight, less than two years hence, with the exception of a new night intruder version, incorporating an even lower-aspect-ratio wing and, probably, two Rolls-Royce R.A. 14 jets (10,000-lb.-plus thrust).

Research

If production were all, the skies of Britain would be swarming with Hunters and Swifts at this date. In addition to being ordered late in the game, both aircraft are actually being held up by technical difficulties rather than production. The Swift has suffered from surging in its Rolls-Royce R.A. 7 jet engine and the Hunter, among other things, has yet to have an approved set of dive brakes. Still and all, some

U. K. AERO EXPORTS*

Since the War

Year	£ sterling
1946	14,463,419
1947	25,055,200
1948	26,004,784
1949	34,215,177
1950	34,275,423
1951	41,955,652
1952	43,933,539
1953	**65,227,188

1953 (by months)

January	4,273,483
February	4,467,502
March	5,087,464
April	4,931,009
May	5,494,768
June	7,119,675
July	6,859,934
August	5,284,472
September	5,402,086
October	5,393,018
November	5,306,930

** Includes complete aircraft, engines, airships, balloons and parts, and rubber tires (outer covers).*

*** Annual rate based on first 9 months of year.*

(Source: Trade and Navigation Accounts of the U.K.)

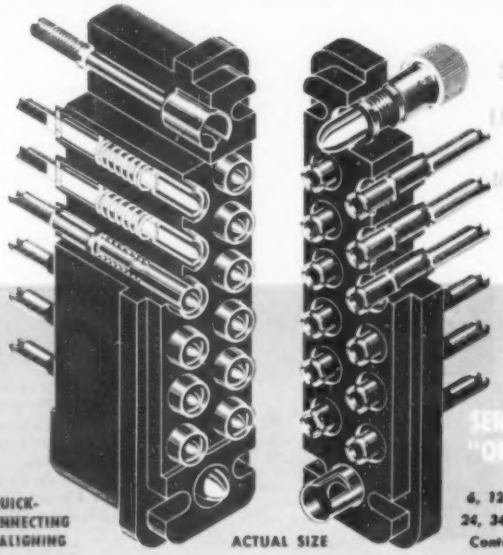
Winchester Electronics
INCORPORATED

MINIATURE and SUB-MINIATURE

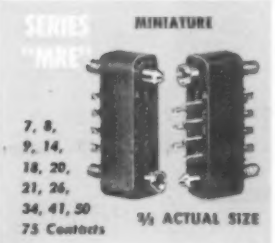
ELECTRICAL CONNECTORS

The Accepted Standard
For QUALITY • COMPACTNESS • RUGGEDNESS
LIGHT WEIGHT • DEPENDABILITY

With components of precision manufacture . . . through strictest quality control standards . . . to assure long and dependable trouble-free service.



See them at the I.R.E. SHOW 388 Microwave Avenue



Always a pioneer in this field, Winchester Electronics initially established the use of mineral-filled melamine for insert bodies and gold plating over silver plating on contacts, having long realized their values. Today, these principles of design and manufacture are widely accepted in industry as those necessary to meet quality requirements.

Many years of engineering experience and manufacturing skill are the basic component of every connector bearing the Winchester Electronics name . . . plus these features:

POLARIZATION: *All connectors have positive polarizing features that make incorrect mating impossible.*

SELF-ALIGNING: *Individually floating contacts assure proper play for self-alignment.*

WIPING ACTION *of contacts insures positive electrical contact at all times.*

MOLDED MELAMINE BODIES: *Mineral-filled (in accordance with MIL-P-14, type MME) provide high arc and dielectric resistance as well as mechanical strength. One-piece molded bodies eliminate unnecessary creepage paths and reduce the number of moisture and dust pockets.*

PRECISION MACHINED CONTACTS: *Pins from brass bar and sockets from spring temper phosphor bronze bar are gold plated over silver for consistent low contact resistance, prevention of corrosion and ease of soldering.*

Winchester Products and Winchester Designs are Available Only From Winchester Electronics, Inc.

Many features are covered by our Patents: Nos. 161900, 162792, 2411861, 2466370, 2513080, 2526325, 2532538, 2633482 and 2659872.

Write or phone our Sales Department for data on connectors listed here, or many other standard and special types available . . . or for solutions to difficult connector problems.

Winchester Electronics
INCORPORATED

GLENBROOK, CONNECTICUT, U.S.A.

West Coast Branch: 1729 WILSHIRE BOULEVARD • SANTA MONICA, CALIFORNIA

Your
BLOWER
PROBLEM
is our
BUSINESS.

Single Stage & Multi Stage
Diameters 2" thru 20"

- HIGH PRESSURES
- HIGH EFFICIENCY
- LIGHT WEIGHT
- COMPACT PACKAGE
- SPECIAL SHAPES
- DEPENDABILITY

Since 1942 we have specialized in Aircraft and Electronic Blower Applications. This 11 years of of "Know-How" is yours when you call us in on your Blower Requirements.

We have 100 Active Models which can be adapted to your specific requirements.

We manufacture the entire unit, including the motor, so responsibility for warranty rests squarely with us and schedules are met.

"THE BLOWER YOU NEED *IS* GUARANTEED!"

DYNAMIC AIR ENGINEERING *Inc.*
7412 Maie Avenue, Los Angeles 1, California

■ BRITAIN

BRITISH GAS-TURBINE AIRLINERS
Ordered To Date

COMET SERIES 1 AND 1A ORDERS:

Ministry of Supply	2
British Overseas Airways Corp.	9[1]
Canadian Pacific Airlines	2[2]
Union Aeromaritime de Transport	3[2]
Air France	3
Royal Canadian Air Force	2
Total:	21

[1] Three lost in crashes. [2] One lost in crash.

COMET SERIES 2 ORDERS:[3]

Ministry of Supply	1 prototype
British Overseas Airways Corp.	12
British Commonwealth Pacific Airways	3
Japan Air Lines	2
Linea Aeropostal Venezolana	3
Panair do Brasil	4
Air France	3
Canadian Pacific Airlines	3
Total:	31

[3] First delivery this year.

(Options for Comet 2s—UAT (number unspecified); CPA—1; BCPA has option for three Comet 2s or 3s.)

COMET SERIES 3 ORDERS:[4]

Pan American World Airways	3 (option for 7 more).
British Overseas Airways Corp.	5 (option 5)
Air India	2
Panair do Brasil	— (option 2)
Total firm orders:	10

[4] First delivery 1956.

GRAND TOTAL COMET ORDERS: 62 AIRCRAFT

(In addition various operators have options on 100 additional Comet Series 2s and 3s)

VISCOUNT 700 SERIES ORDERS:

Ministry of Supply	2
British European Airways[5]	38
Air France	12
Aer Lingus	4
Iraqi Airways	3
Trans-Australia Airlines	6
Hunting Air Transport	3
Trans-Canada Air Lines	15
Indian Government	2
British West Indian Airways	3[6]
Fred Olsen (Norway)	2
Total:	90

[5] Including 12 Viscount 802s. [6] Now negotiating.

BRITANNIA ORDERS:

Ministry of Supply	1
British Overseas Airways Corp.	33 (plus an option for 2 more).
Qantas Empire Airways	6[7]
Total:	40

[7] *Letter of intent to purchase signed.*

(In addition, the possible sale of 51 additional Britannias to at least seven other airlines is under negotiation.)

70 Hunters are flying or near first flight today.

All told the British aircraft industry, now 230,000 men strong, has been expanding at a 2,000-men-a-month clip recently, and most of the newcomers are production personnel.

▶**New Developments**—Harder to illustrate because of the security laws, are the new British air developments in the mill which promise to make an original contribution to Western defense. Visitors to Farnborough over the last few years have seen a few hints, and those here this year will see some more.

As one top RAF officer put it: "We feel it is absolutely fundamental that we do our own strategic thinking."

▶**Three Vs**—Top priority among RAF planners today goes to Britain's three medium bombers, the delta-wing Avro Vulcan (four Bristol Olympus jets), the Handley Page Victor (four Armstrong Siddeley Sapphires) and the Vickers Valiant (four R-R Avon R.A. 14s). The shape, alone, of the "Three Vs" indicates an original approach to the problem of strategic bombing.

"Flexibility" is a word RAF policy makers use a lot these days. It applies with force to the three Vs. All can take off from virtually any military airport in the Commonwealth. Indeed, short takeoff runs were a primary consideration in their design (AVIATION WEEK Oct. 19, 1953, p. 14).

Ranges are estimated between 5,000 and 7,000 miles. (Flight Refuelling, Ltd., equipment is being built into all three.) As lone raiders, using speed, darkness and weather for protection, they make very promising nuclear bomb carriers. They inspired RAF Bomber Command's famous slogan, "A rapier, not a bludgeon."

▶**Hit Them First**—This year a second major concept, high on the list of RAF priorities, will come to light. RAF officials lately have been talking about all-weather fighter defenders capable of hitting enemy bombers over or near their home bases. Armed with missile armament, these intruders would, ideally, try to intercept enemy bombers on their initial climb.

First British aircraft with this mission promises to be the show-stealer at Farnborough this year. Produced by English Electric, it is a sweptwing twin-jet fighter, research for which is being carried out by the Short Bros. S.B. 5 experimental model with manually adjustable wings. The English Electric aircraft will have not much less than 70 deg. sweep. Production versions are likely to show English Electric's continued reliance on Rolls-Royce for engines.

▶**Missiles Under Wraps**—When the fog of security lifts, Britain can be ex-

dependable subminiature indicator lights

WITH W-I-D-E ANGLE VISIBILITY

Light "piped" throughout entire periphery of long plastic lens assures easy visibility of signal from all sides.

- Smaller, truly subminiature size
- Fully illuminated lens is clearly visible from any angle
- For either standard or edge-lit panels
- Designed to meet critical aviation performance standards

Larger illuminated area... smaller physical size

Smaller than most subminiature lamps, yet with uniformly bright wide-angle visibility, Hetherington L6000 Series make ideal indicator or warning lights for critical military as well as many commercial applications. Using AN-3140 lamps fitted into a heavy plastic lens $^{27}/_{64}$" long, these rugged lights are $1^{1}/_{32}$" overall, and mount in a $^{13}/_{32}$" hole. Details in Bulletin L2.

"Standard" Hetherington Lights Fill Most "Special" Requirements

EDGE-LIT PANEL MOUNTING Series L2000

. . . for MIL-P-7788 panels. Sturdily constructed of nickel-plated brass with integral molded-in terminal and snug-fitting plastic lens that will not vibrate loose. Easy to mount. Write for Hetherington Bulletin L1.

REGULAR PANEL MOUNTING Series L1000

Combines exceptionally small size and light weight with durable vibration-resistant construction. Sealed against moisture. Terminal is molded into the assembly. Ask for Bulletin L1.

"PUSH-TO-TEST" INDICATORS Series L3000

Ideal for many military as well as industrial uses. Bulb is lit by pressing spring-mounted lens button. Supplied with or without silicone boot for moisture protection. Send for Hetherington Bulletin L1.

SWITCHES WITH BUILT-IN LIGHTS . . .

Developed originally by Hetherington as hostess call lights, these compact little units are now available for a broad range of exacting commercial or military aircraft services. Write for Hetherington Catalog.

HETHERINGTON

SHARON HILL, PA.

West Coast Division: 8568 W. Washington Blvd. Culver City, California

Indicator lights • Switch-indicator light combinations • Push-button, snap action, and toggle switches • "Hi-G" Relays • Aircraft and Electrical Equipment Assemblies.

Warner's Extension Power Brake Valve, shown above, has an exclusive hydraulic feed-back feature to give the pilot immediate warning in event of hydraulic system failure. This compact, lightweight, space-saving valve is adaptable to a wide range of system and brake pressures.

Warner is qualified by experience and facilities for the design and production of critical hydraulic equipment for a wide range of uses. Warner engineers will welcome an opportunity to assist you in the development of special hydraulic equipment to meet your particular requirements.

Write for your copy of the illustrated folder shown above describing typical examples of Warner precision hydraulic equipment.

Warner DIVISION OF DETROIT HARVESTER CO. OF N.Y. INC.
21533 GROESBECK HIGHWAY • P.O. BOX 3886 • DETROIT 5, MICHIGAN
DESIGNERS AND MANUFACTURERS OF PUMPS • VALVES • ACTUATORS

■ BRITAIN

pected to have much to offer Western defense chiefs in the missile line. Both industry and RAF spokesmen have led observers here to look for an accent on air-to-air and air-to-ground missiles.

Because money is so tight, the RAF is always extremely reluctant to order anything that promises marked improvement within a reasonable amount of time. Largely for this reason, Britain hasn't a single missile in production today.

Minister of Supply Duncan Sandys summed up the missile situation this way last fall: "The first phase is the design and construction of prototypes. The second is the carrying out of trials and the introduction of such modifications as the trials show to be necessary. Thirdly, there is the manufacturing stage. . . . It is the trials stage which we are now entering with several rocket weapons." Trials are going on at Australia's giant Woomera range.

▶ **Boundary Layer Control**—There are many other British military developments lying behind security. One avenue of study currently causing a lot of excitement here as in the U.S. is boundary layer control, or the use of jets in lift. In a speech this winter, Sir Frederick Handley Page saw in this direction a development "even more profound in its effect than the introduction of metal aircraft in the 1930s."

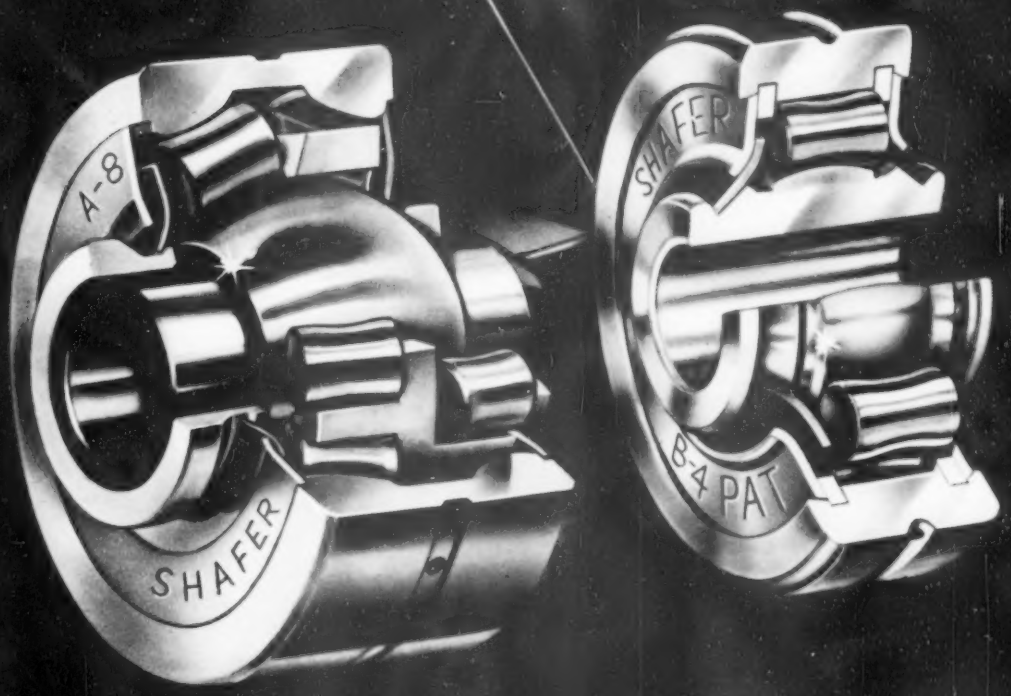
"The introduction of jet propulsion," said Sir Frederick, "led to a new design philosophy which aims at the integration of propulsion and lift production." Large quantities of air, he pointed out, are available from the engine, which can be tapped to effectuate some form of boundary layer or circulation control.

Sir Frederick claimed that basic research so far indicated that substantial improvements in performance, due to drag reduction or lift augmentation, can be obtained through bypassing of power to control the boundary layer or circulation, and hence the lift of the wing. "Alternatively," he concluded, "the whole problem of takeoff may be revolutionized by the incorporation of jet thrust into the lifting system."

Shortly after this speech, one of Britain's leading engine designers told members of the British aviation press that they should "push" the idea of researching boundary layer control instead of spending money for newer and longer runways.

▶ **Spending Their Own**—One of the healthiest signs in British aviation is the fact that many, if not most, British aircraft companies spend some of their own money pursuing military research projects not underwritten by the government. Part of this spending is motivated by the fact that the competition

SHAFER



CATALOG NUMBER 54

Send for your copy today

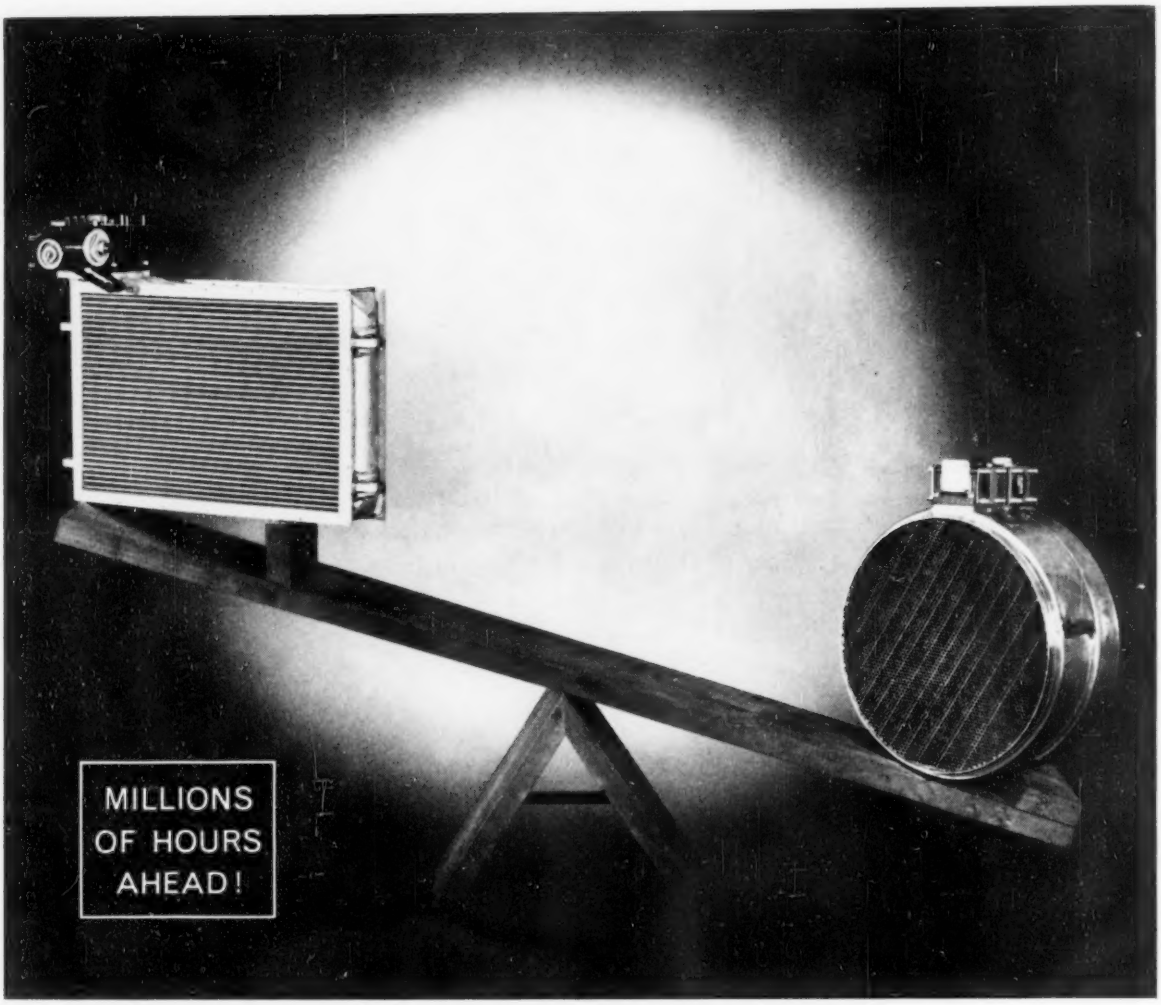
Aircraft

ROLLER BEARINGS

SHAFER

DIVISION OF **CHAIN** BELT COMPANY

801 Burlington Ave., Downers Grove, Ill.



Equal performance at one-fourth the weight!

NEW AiRESEARCH OIL COOLER SAVES SEVENTY POUNDS OVER EARLY TYPE

AiResearch designed and produced the first lightweight heat transfer units for aircraft in 1939. Leadership in this field has been maintained by more than a half million hours of research and development, and by unparalleled experience — 500,000 units produced and almost three hundred million operating hours.

The unrelenting effort to reduce weight and size and to improve performance continues. One result: this new oil cooler which weighs only 22.5 lbs. It is seventy pounds lighter than original units of equal capacity.

AiResearch manufactures oil coolers which range from a capacity of below 100 BTU's to many thousand BTU's per minute. These units — and all other AiResearch heat exchangers — excel in efficiency in relation to size and weight.

If you have a heat transfer problem which requires high performance and efficiency from a small, lightweight unit, consult our engineering-manufacturing team.

AiResearch Manufacturing Company

A DIVISION OF THE GARRETT CORPORATION

LOS ANGELES 45, CALIFORNIA · PHOENIX, ARIZONA

Designer and manufacturer of aircraft equipment in these major categories

between companies for the very limited government research money is so intense. By starting off on their own, the companies hope to get a jump on their neighbors.

• **De Havilland** financed its new Gyron jet through initial bench tests before the government stepped in with an order. The Gyron, sure to be in the 20,000-lb.-thrust class, is a fighter engine, which will probably see the air first in a new Naval version of the D.H. 110 all-weather fighter.

• **Fairey Aviation**, for a not untypical example, has sunk $10 million of its own money into military research since the war, most of it on guided missiles and related work. And Fairey is a tiny company by American standards.

• **Short Bros.** last year financed privately the Sherpa research project, to test the possibilities of the aero-isoclinic wing form. (While 80% of Short's assets are owned by the government, only one director is a civil servant.)

• **Folland.** Probably Britain's most enterprising aviation capitalist today—in the military field anyway—is W. E. W. Petter, designer of the English Electric Canberra and now managing director of Folland Aircraft, Ltd., a big subcontractor to the industry. Petter is using his own money to build two prototypes, generally referred to as the F. O. 141 Gnat. These are Britain's first light fighters. The first should fly in the fall.

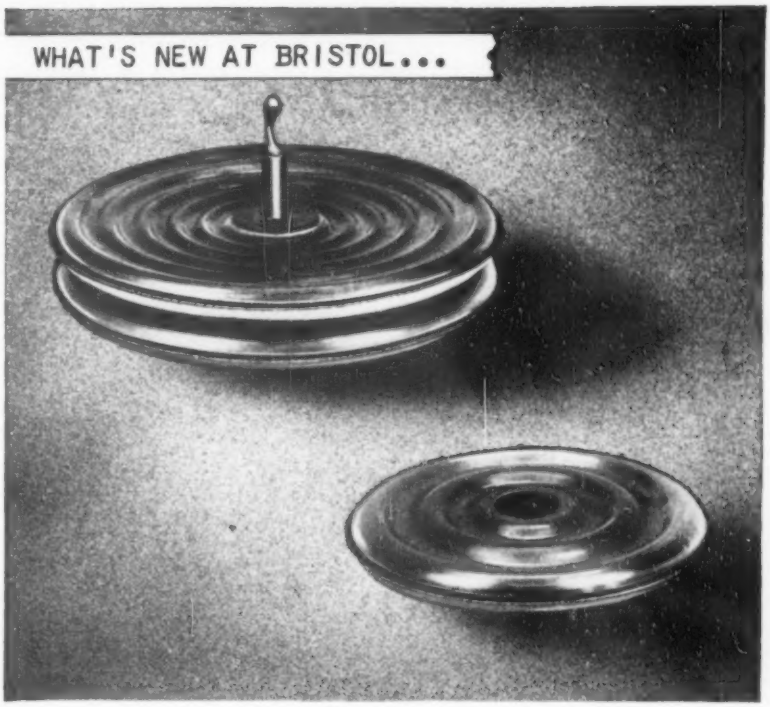
The Gnat's design gross weight is only 6,000 lb., but with it Petter promises to give a day-fighter performance in the class of the Hunters and Swifts. (Production Gnats will have a thinner wing than the prototype and are quoted as being designed for speeds to Mach 1.05.)

Bristol is building Petter an engine—the Orpheus—of around 5,000-lb. thrust. But the prototypes will fly on Armstrong Siddeley Viper jets of less than 2,000-lb. thrust.

Petter's big selling point is the Gnat's low price—about $70,000 each on a quantity order. This is hardly a third of the cost of Hunters and Swifts. Petter thinks this is the answer to the problem of making defense and economics agree in western Europe. He has presented his case strongly to NATO officials in Paris.

Thoroughly committed to Swifts and Hunters, RAF top brass has turned a deaf ear to Petter's arguments for the Gnat so far.

What is Petter sacrificing to get his performance at that weight, the RAF wonders. After all, Hawker Hunter designer Sydney Camm accented weight saving in the Hunter to the limit of his ability—so much so that he had plenty of headaches finding enough



High-precision diaphragms set new standards for accuracy, repeatability, and uniformity

• Bristol's new arc welded diaphragms of extremely thin (0.003″ to 0.020″) stainless steel, Ni-Span C, and phosphor bronze are now available for pressure transducers, pressure elements, and seals for many applications in the instrument and aircraft industries.

The result of 65 years of experience in the manufacture and application of hundreds of thousands of pressure measuring instruments, Bristol's diaphragms give uniformly accurate performance under low and high temperature conditions.

The accuracy, repeatability and uniformity of these pressure-sensitive diaphragms are made possible by Bristol's specially developed arc welding equipment, laboratory-controlled heat treating and evacuating processes and the use of the latest leak detection equipment. You can get the diaphragms for pressures of from 1″ water pressure, full travel up to 150 psi. Write for more information to The Bristol Company, 130 Bristol Road, Waterbury 20, Conn. 4.21

BRISTOL

Points the Way in Human-Engineered Instrumentation

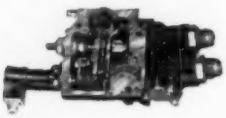
AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

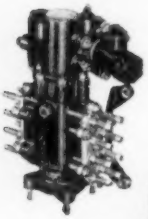
The Mark of a Leader in Precision Machining

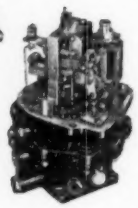
fuel controls, precision parts and assemblies . . .

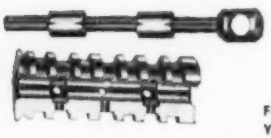
built to exacting specifications by

PIERCE









Engineering Assistance—Pierce engineers will work closely with you, give you the benefit of our more than 40 years' experience in design and manufacture of engine speed and fuel controls, servo mechanisms, high-precision parts and assemblies.

Experimental Work—Pierce will build pilot models to your specifications, assist in testing and experimental work, set up tooling and production procedures and help carry development projects quickly and economically to production stage.

Production Runs—Our modern, fully equipped plants are available for production of component parts for jet aircraft engines . . . fabrication of parts, precision machining and assembly . . . to your most exacting specifications.

For Quality . . . Precision . . . Satisfaction, call on PIERCE. Your inquiry will receive our immediate attention.

ask for new brochure—"40 Years of Manufacturing Precision Controls"

The Pierce Governor Co., Inc.

1684 OHIO AVENUE, ANDERSON, INDIANA

PIERCE

■ BRITAIN

range and room for such things as dive brakes.

But the British Army, worrying whether there will be enough Hunters and Swifts to provide adequate ground support, and the British Navy, intrigued with the idea of Gnats on its baby flattops, are showing interest. And Petter has high hopes that somehow U.S. financial backing can be found for the Gnat, although it surely must be predicated on a British order first.

Civil Aviation

Other persons exuding confidence in British aviation are the makers of Britain's famed civil jet transports.

There are now almost 200 firm orders for de Havilland Comets, Vickers Viscounts, and Bristol Britannias. All, save three Comet 3s ordered by Pan American, are for customers outside the U. S.

Considering that there are hardly more than 1,000 mainline transports operating in the free world outside of the U.S., the British have made a good start. Most important, virtually all of their customers are converts from U.S. equipment.

► **Vickers Viscounts**—Vickers, with its

EMPLOYMENT IN THE UNITED KINGDOM'S AIRCRAFT INDUSTRY

Employment in the "Manufacture and Repair of Aircraft" reached 227,400 at the end of October, an increase of 2,500 on the previous month.

	Males	Females	Total
1949			
June	130,700	21,300	152,000
December	131,200	22,000	153,200
1950			
June	128,000	21,900	149,900
December	131,300	22,300	153,600
1951			
January	134,100	23,000	157,100
February	135,800	23,500	159,300
March	137,000	23,600	160,600
April	138,000	23,900	161,900
May	137,240	24,350	161,590
June	138,800	24,600	163,400
July	139,600	24,700	164,300
August	141,100	25,100	166,200
September	143,600	25,900	169,500
October	145,800	26,700	172,500
November	147,300	27,000	174,300
December	149,300	27,200	176,500
1952			
January	151,500	27,900	179,400
February	155,600	28,500	184,100
March	157,700	28,800	186,500
April	159,800	29,300	189,100
May	163,870	29,730	193,600
June	164,500	30,200	194,700
July	165,400	30,300	195,700
August	167,500	30,800	198,300
September	169,300	31,000	200,300
October	172,300	30,900	203,200
November	173,900	30,900	203,800
December	175,200	31,000	206,200
1953			
January	177,000	31,300	208,400
February	178,500	31,500	210,000
March	180,700	31,700	212,400
April	182,400	32,000	214,400
May	184,400	32,300	216,700
June	185,600	32,400	218,000
July	186,500	32,300	218,800
August	188,900	32,700	221,600
September	191,900	33,000	224,900
October	194,000	33,400	227,400

Bendix jet ignition systems . . .

streamlined for maximum efficiency!

Although jet ignition is a comparatively new development in the fifty year span of powered flight, progress in this vital phase of aviation has been truly remarkable.

Unlike ignition design for reciprocating engines, which has remained relatively constant, jet ignition has gone through several major design changes within the past few years.

For example, a comparison of the TLN-10 jet ignition system, produced by the Scintilla Division of Bendix, with earlier designs shows significant improvements in every operating characteristic —and at the same time original cost, operating expense and weight are substantially reduced.

Here, indeed, in the Scintilla TLN-10 jet ignition system, is a classic example of how the present national policy of greater value for the taxpayer's dollar is being put into practice.

SCINTILLA DIVISION OF Bendix

SIDNEY, NEW YORK

Bendix

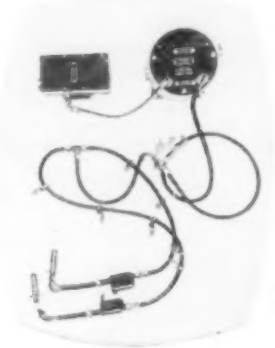
Export Sales: Bendix International Division, 205 East 42nd St., New York 17, N. Y.

FACTORY BRANCH OFFICES: 117 E. Providencia Ave., Burbank, Calif. • Brouwer Bldg., 176 W. Wisconsin Ave., Milwaukee, Wisc. • Stephenson Bldg., 6560 Cass Ave., Detroit 2, Mich. • 512 West Ave., Jenkintown, Pa. • 8401 Cedar Springs Rd., Dallas 19, Texas • American Bldg., 4 S. Main St., Dayton 2, Ohio

TLN-10 SYSTEM

WEIGHT 7 LBS.

- Lower Cost—Simplified Service—Weight Reduction—Requires less current.
- Higher wattage available at igniter plug—Improved starting over entire range of operation—Virtual elimination of plug fouling difficulties.
- The TLN uses low voltage only and eliminates problems encountered with production and control of high voltage, such as dielectric losses, corona, capacitance loading, and flashover.
- Smaller size—Easier installation—Leads used will withstand exceptionally high temperatures—TLN-10 System is engine mounted whereas TEN-1 was both plane and engine mounted.



EARLY DESIGN

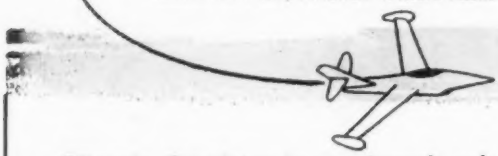
WEIGHT 37 LBS.

(Advertisement)

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.



There's chemistry in an aircraft valve — a fact I hadn't considered until the other day when I talked with Luke Hiltner.

I say "talked with" Luke. Actually, he did all the talking and I listened. So, with your permission, I'll try merely to summarize the points made by this tall, five-year Whittaker specialist, a UCLA graduate and formerly a Lockheed engineer.

"A product," he said, "is no better than its weakest link, and in the case of aircraft valves that link can be the seal of a synthetic 'O' ring. Unless it's of the best quality, the unit just won't function as it should.

"You see," he explained, "the compounding of synthetic rubbers was only in its infancy following World War II. New fuel specifications with lowered temperature requirements gave existing compounds a rough time, for they developed a high volume swell in aromatic fuel. This naturally burdened Whittaker designs, and we searched for relief.

"Finally we went into rubber compound research ourselves and together with the Stillman Rubber Company achieved the second approved source of AF-934 'O' rings with the desired reduction in swell.

"Yet lower temperatures and aromatic fuels continued to give us trouble until we studied the new material, Teflon, which is unaffected by the fluids encountered in our business and remains flexible in low temperatures. There were disadvantages, however, for we found Teflon did not have the natural resilience of rubber and it did have an adverse cold flow characteristic.

"Through analysis and research we came up with the answer—spring-load the synthetic compound and design shear-type seals to overcome the expansion and cold flow characteristics. This innovation works perfectly in our new fuel designs."

Luke jumped next to the subject of lubricants, always a problem in mechanical designs, especially when you're dealing with a variety of fluids and an extreme temperature range.

He pointed out that Whittaker was among the first to use dry film lubricants successfully – the types that are sprayed and baked on to give a tough, resistant surface.

"In fact," he said, "through these dry lubricants we were able to change from heavy aluminum valves with a maximum use temperature of 500 degrees F. to steel butterflys with an ever-increasing limit that moved up to 750 degrees. At the same time we saved weight, too.

"But bearings gave trouble," he continued, "and the outside limit appeared to be 750 degrees. However, Whittaker researchers have found that with the proper use of special metals, shaft bearings will hold up under 900 degree heat and operate red-hot and smoothly without added lubrication."

Temperatures also brought problems in lubricating greases, with organic greases inadequate and silicone lubricants lacking effectiveness with certain metal combinations.

"Then we discovered," Luke mentioned matter-of-factly, "that for our actuator gear trains, a mixture of organic grease with silicone oil improved both lubricity and temperature range beyond the capability of either lubricant alone."

In passing, Luke also disclosed that Whittaker recognized the hard anodizing process so quickly that the company was the first manufacturer on the West Coast to be licensed by ALCOA to use the method (on the Whittaker Ratio Flo Liquid Flow Divider).

"We'd been working along similar lines, though," he added, "and had tried nickel plating aluminum to offset its softness and galling tendencies as bearing material. We were even experimenting with the electroless nickel process."

So far I had managed to understand at least part of what Luke was saying, but then he went into materials and processing – the proper selection of metals and the use of plating "to combat galvanic and electrolytic corrosion."

"This is an important part in the quality and performance of our product," he went on. "Our research and development must keep up with all the new materials and processes on the market . . .

"Polyester resins are used in potting noise filters. Epoxy and phenolic adhesives are used. Nylon, Formica, Vinyls, Teflon and Silicone products are more of the new synthetics we have accepted. Tantalum, tungsten and molybdenum are some of the precious metals used in our products . . ."

Truly it is said that progress is continually pressing physical limits — and far outdistancing the comprehension of the layman!

■ BRITAIN

turboprop Viscount, stole the show last year and is likely to do so for most of this year. So far, 90 Viscounts, worth more than $55 million, have been sold. Vickers has delivered 18 to British European Airways and six to Air France. BEA has 10 more Viscount 701s coming and Air France six more. Between them these two operators will have Viscounts operating into every European capital and many Middle East centers this year.

Aer Lingus will have its three Viscounts around mid-year; will operate them between Dublin and London and from Dublin to Manchester, and Amsterdam. By fall, Trans-Australia Airways will have Viscounts running Down Under on intercity services. And perhaps before the end of the year, Trans-Canada Air Lines will have the first of their 15 Viscounts flying into New York.

Early this year Vickers will announce details of its Viscount 802, a dozen of which BEA has ordered. The 802 is a revision of the 801 which BEA ordered just a year ago. With the same payload (66 to 82 passengers) and the same gross weight (65,000 lb.), the Viscount 802 is designed for economical operation up to 900 miles, whereas the 801 was a specialized aircraft designed for high-density, 300-mile stage lengths. The greater flexibility in cost per ton-mile of the 802 over the 801 is made possible by the fact that Rolls-Royce has continued to find both new power and new economies in the Dart turboprop.

Darts now are giving 1,400 shp. plus 365 lb. of thrust for BEA in service. In their first six months of operations with BEA, Viscount 701s showed a cost per capacity-ton-mile of about 43 U.S. cents. Already Vickers has announced new versions of the Dart with 9% savings on fuel consumption and 8% increase in speed. By the time the 802s get flying, the Dart should show even more economy and power—building up from the present 300-plus-mph. cruising speed to about 350 mph. in the 802s.

► **De Havilland Comet**—In contrast to the Viscount, the past year has been the year of the troubles for the de Havilland Comet. Orders for Series 2 and Series 3 Comets moved up very little over the year, as customers held off to see what would have to be done as the result of mishaps with the Comet 1s.

Takeoff accidents with the Comet 1s at Rome and Karachi have led to a redesigned leading edge on the Comets 2 and 3, in order to give more lift on takeoff.

BOAC has introduced 50 mechani-

the man from Esso...

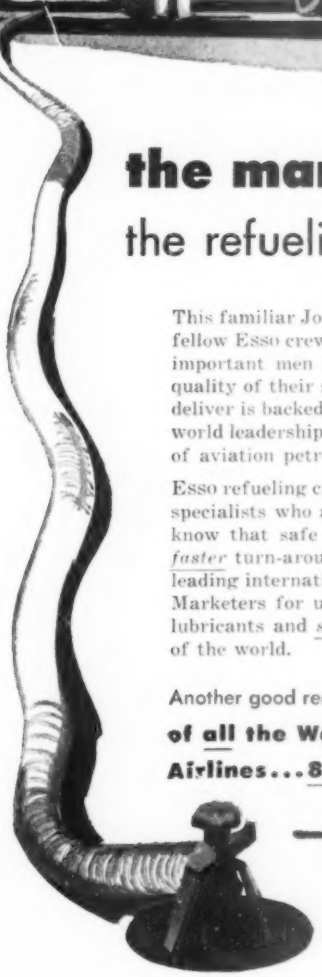
the refueling crew man

This familiar Joe, José or Giovanni and his fellow Esso crew men around the world are important men in the aviation industry. The quality of their services and of the products they deliver is backed by more than half a century of world leadership in the research and development of aviation petroleum products.

Esso refueling crew members are trained specialists who are proud of their jobs. They know that safe and efficient servicing means *faster* turn-around for aircraft. Operators of leading international airlines rely on Esso Marketers for uniform high quality of fuels, lubricants and *service* along the airways of the world.

Another good reason why:

of all the World's International Airlines...8 out of 10 use



Esso

AVIATION PRODUCTS

Land-Air

PUTS MISSILES UNDER A MICROSCOPE

Tracking a missile that knifes its way into the ionosphere and beyond at speeds faster than 2000 miles per hour is more than following it with a pair of high-power binoculars or radar eyes.

Facts are needed. Its course, speed, temperature of the air around it, air pressure, skin friction . . . *space position intelligence.* This information must be collated with ground information to provide a true and accurate picture of missile performance.

Projects like this require special *instrumentation* and *development research* in the instrument, optical and electronics field, both ground and airborne. This is the special field of Land-Air's Instrument and Electronics Division at Alamogordo, New Mexico. In actual practice, this research resulted in improved radar, servo-operated tracking cameras, new and accurate time-signal generators, wire-line and radio signal links, sequence chain radar, and complex intercommunication networks.

The Land-Air teams that produced these results are available for sub-contract developmental and research work on *your* project. Their invaluable experience and techniques have wide application in the field of avionics.

Write for this booklet describing Land-Air services now . . . or, better yet, call our main office. A Land-Air engineer-representative will call on you at your request.

LAND-AIR, INC.

Subsidiary of California-Eastern Airways, Inc.

GENERAL OFFICES • *201 North Wells Street, Chicago 6, Illinois*

■ BRITAIN

cal modifications in the Comet 1, most of which will be incorporated in the Comets 2 and 3. Both operator and manufacturer are sparing no expense in learning their hard lessons.

But still unanswered at this writing are the causes of the two major BOAC Comet 1 disasters near Calcutta last May and off the island of Elba in January. Both of these aircraft broke up during climb for reasons which are still shrouded in mystery. Questions are bound to persist on such points as the adequacy of the Comet's fully power-operated controls or the behavior of kerosene fuel under certain conditions of temperature and pressure. Probably only accident-free hours in service will ultimately restore full confidence in the Comet.

Following its policy of pushing production and introducing modifications on the line, DH has moved ahead with both the Series 2 and the Series 3 Comets. The Series 2, with four Rolls-Royce Avon Mark 502 jets giving upwards of 7,000-lb. thrust, has almost completed its initial flight tests. To show its stuff, the Comet 2 prototype in January made a nonstop flight from London to Khartoum. The figures were impressive: Distances, 3,080 miles; average speed, 481 mph; payload, 10,500 lb. equivalent (capacity); fuel load, 6,900 gal. DH test pilot John Cunningham landed at Khartoum with 1,120 gal. of fuel left. The stated range of the Comet 2 is about 2,600 miles.

This summer the eagerly awaited Comet 3 prototype (four Rolls-Royce Avon R.A. 16 jets of 9,500-lb. thrust) will make its first flight. Operations-wise, the Comet 3's main advance is boosting capacity from 44 passengers in the Comet 2 to 58 passengers.

► **Reverse Thrust**—But there will be some technical changes, too. Most interesting will be de Havilland's reverse-thrust mechanism designed to give extra braking to the 140,000-lb. Comet 3.

Chances are the mechanism will appear on one of the first three Comet 3s, but not on the prototype. It has been described as working after the fashion of an eyelid, closing off the tail of the jetpipe, and directing the efflux through guide vanes in a generally downward and forward direction.

De Havilland is the strongest of Britain's aircraft builders financially. The company has virtually staked its future on Comets. It would be a pessimistic observer indeed who didn't predict that the Comet will revive this year with a vengeance.

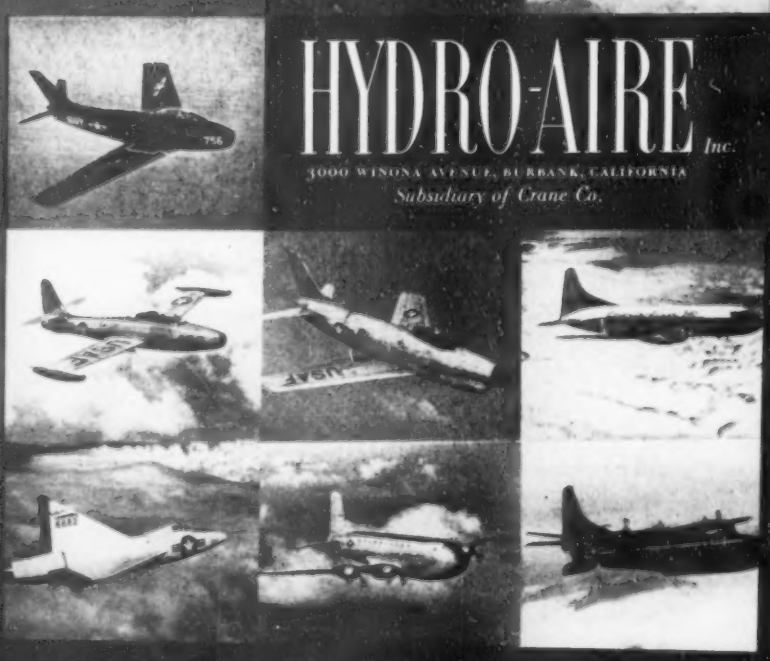
In any case, civil jet operators years hence will owe many millions which they will never have to pay for the knowledge BOAC and de Havilland are

HYTROL ANTI-SKID BRAKING SYSTEM
PNEUMATIC VALVES
SNIFFLE VALVES
PURGE VALVES
LOX VALVES
PLUG VALVES
HYDRAULIC SHUTTLE VALVES
PRESSURE-OPERATED SHUT-OFF VALVES
HYDRAULIC CHECK VALVES
RELIEF VALVES
MOTOR-OPERATED SELECTOR VALVES
SEQUENCE VALVES
MOTOR-OPERATED SHUT-OFF VALVES
SLIDE VALVES
TURBO-MACHINERY
HY-V/L FUEL BOOSTER PUMP
TRANSISTORS & THEIR APPLICATIONS
CABIN PRESSURIZATION EQUIPMENT
VENT VALVES
BUTTERFLY VALVES

...AND STILL, IN 1954

every fighter, every bomber,
every transport is Hydro-Aire equipped

PRESSURE SWITCHES
INTERVALOMETERS
REGULATORS
FILTERS
GATE VALVES
FLOAT SWITCHES
HYDRAULIC PUMPS
PRESSURE REGULATORS
JET ENGINE ACCESSORIES
ELECTRO-MECHANICAL ACTUATORS
TANK PRESSURIZATION EQUIPMENT



HYDRO-AIRE Inc.

3000 WINONA AVENUE, BURBANK, CALIFORNIA
Subsidiary of Crane Co.

if you need aircraft

BUSHINGS
and
SPACERS

to NAS specifications or your own

CALL, WIRE or WRITE

HONTI

ENGINEERING & MANUFACTURING CO.

1410 DE LA TORRE WAY
LOS ANGELES, 23, CALIF.

Phone: ANGELUS 27830
Cable: HOENG LOS ANGELES

Contractors to:

U. S. AIRFORCE, CONVAIR SAN DIEGO & FORT WORTH DIV., NORTH AMERICAN AVIATION, CANADAIR, AMERICAN & CANADIAN CAR FOUNDRY CO., DOUGLAS AIRCRAFT, ETC. ETC.

Also available at HONTI

PINS, THIMBLES, ROD ENDS, STAINLESS STEEL MACHINE BOLTS ROD AND BEARING

ASSEMBLIES

BRITISH MILITARY AIRCRAFT EXPORTS . . .

On Order Or Delivered 1953
(Numbers given in brackets where available)

Aircraft	*Purchaser*
Armstrong Whitworth Meteor N.F.11	France [2nd order].
Auster A.O.P.	South Africa.
" Aiglet	Arabia.
" Cirrus Autocar	Australia.
Avro Lancaster	France [59].
" Shackleton	South Africa.
Boulton Paul Balliol	Ceylon.
Bristol 171 Mk.50	Australia [2nd order].
de Havilland Chipmunk	Indonesia.
" " Devon	New Zealand.
" " Vampire fighter	Chile, Finland [3], South Africa.
" " Vampire trainer	Iraq, Norway, Portugal, South Africa, Sweden.
" " Venom N.F.2	Venezuela, Sweden.
English Electric Canberra B.2	Venezuela [12].
Fairey Firefly T.T.	Sweden [2nd order making total of 12].
" Gannet	Australia [40].
Gloster Meteor T.7 & F.8	Brazil [70].
" Meteor F.8	Israel, Syria [14].
Percival Pembroke	Southern Rhodesia [4].
" Provost	Southern Rhodesia.
Short Sealand	India [10], East Bengal [2].
" Sunderland	New Zealand [16].
Supermarine Attacker	Pakistan.
Westland S-51	Yugoslavia.*

* "Offshore" order.

learning the hard way now.

► **Bristol Britannia**—Up until the second prototype crash-landed last month, it was expected that this year the Bristol Britannia turboprop would join Britain's other two aces in becoming a practising carrier. But this was the aircraft earmarked to do Bristol's certificate of airworthiness tests. (The first prototype was not built to a production standard.) The tests are delayed now for some months until Bristol gets its first production model flying.

Now it will be the summer of 1955 before BOAC gets the first of its 15 Mark 100 Britannias into service. They will start on BOAC's West African runs before entering the North Atlantic tourist service, carrying 92 passengers between London and New York.

The Mark 100s are powered by four Bristol 705 turboprops, giving 3,780 eshp. each. Only 15 will be built. Subsequent Britannias—for BOAC and Qantas Empire Airways—will be Mark 300s with four Proteus 750s giving 4,150 eshp. (Both BOAC and Qantas have also ordered Mark 250 versions, same as 300s, only rigged for half passenger, half freight loads.)

Tooling for production of Mark 300s has already started at Short Bros., Belfast. Ultimately, Short and Bristol will each produce 25 Britannias a year. This investment indicates that there is more than speculation behind Bristol's claim that there are 51 new orders (in addition to the 40 already placed) in the advanced talking stage.

Canadair plans to build a maritime reconnaissance version of the Britannia in Canada for the RCAF. Curtiss-Wright Turbo Compound engines will most likely be the choice for the Britannia MRA's since the mission will require prolonged low-level cruising. Proteus turboprops eat up too much fuel for this.

As Britain's first entry on the North Atlantic routes, the Britannia is definitely the plane to watch in the near future. The Britannia promises to do the London-New York run in not much over 13 hours, carrying a payload in excess of 25,000 lb. Fuel used would fall somewhere under 60,000 lb.

New Transports

All this year and next, you'll be hearing a lot about the the second generation of British turbine transports —the generation most likely to equal the first U. S. civil jet projects in range,

speed, and capacity. The competition among advocates of big turboprops, bypass jets and turbojets is fierce.

There are three big British projects:

- **De Havilland's design for a "Comet 4."**
- **Bristol's design for a "Super Britannia."**
- **Vickers V-1000 military jet transport prototype (with its civil version, the VC-7).**

Bomber-builders A. V. Roe and Handley Page like to talk about their civil versions of the delta-wing Avro Vulcan and the crescent-wing H. P. Victor. Known respectively as the Avro Atlantic and the H.P. 97, these ideas exist now in the form of two impressive models. But neither is a likely starter in the big race. Avro might eventually come up with a serious civil type since the Hawker Siddeley Group, of which Avro is a member, is alone among big British companies in not having any civil projects.

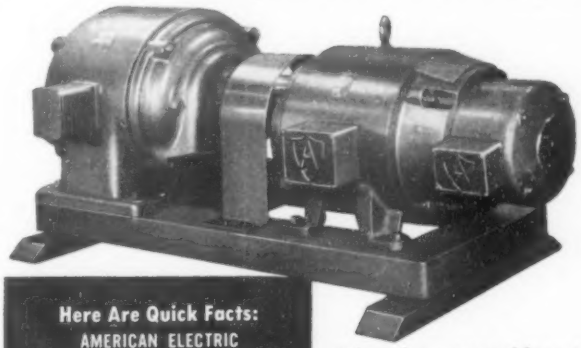
▶ **Vickers 1000**—Of the three serious projects, powerplants are going to spell success or failure. "After all," says George Edwards, managing director and chief designer of Vickers' Aviation Division, "what's an airframe but a few hunks of bent metal, hitched together with their edges rounded off."

Edwards is championing the 13,000-lb.-thrust Rolls-Royce Conway bypass jet, four of which will power the Vickers 1000 prototype. As far as complication goes, Edwards tells visitors he regards the Conway as "proved." He figures he'll get up to 10% savings on fuel consumption over comparable turbojets and around 50 mph. more speed than comparable big turboprops.

Most important, with a prototype order in hand, Vickers will be first off the mark. The V-1000 should fly in 1955. So far there is only an order for a prototype from RAF Transport Command. But both BEA and, lately, BOAC are wooing Vickers ardently. BOAC is anxious to beat the Americans with a nonstop trans-Atlantic jet carrier. Dreamer Peter Masefield, chief executive of BEA, summed up his ideas on the V-1000 in a pseudo-poetical vein: "The 100-passenger 'Victory Class' aeroplane taxis out (at London), landing time in Rome due little more than two hours ahead; then on to Athens and Cairo and back to London the same day—4,500 miles and five stops in a reasonable aircraft day." Masefield sees all this within 10 years.

Edwards confidently predicts his military prototype will double for a civil prototype—to be called a VC-7. Edwards isn't anti-turboprop by any means. And that's not just because he's had so much success with the Rolls-Royce Dart in his Viscounts. Edwards has on the drawing boards a "Vickers 900" project, which probably will use

Are your High-Cycle Alternator requirements *special?*



Here Are Quick Facts:
AMERICAN ELECTRIC REVOLVING FIELD ALTERNATORS

CAPACITY RANGE—15 KVA to 40 KVA (in stock). Up to 75 KVA on special order.

FAST RECOVERY—Better than .2 seconds.

LOW VOLTAGE OVERSHOOT—Less than 10%.

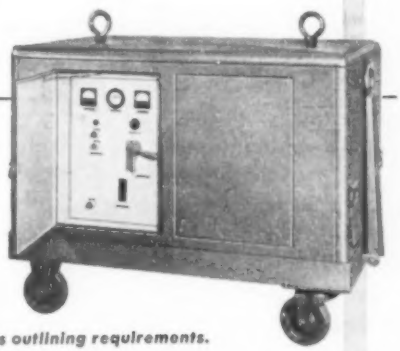
TOTAL HARMONIC CONTENT—Under 5% on unbalanced 3-phase loads.

These characteristics apply to general uses. Where applications are specific, even better characteristics can be developed.

Where lowest possible maintenance, combined with excellent wave form characteristics are required, it's hard to match American Electric's Inductor-Type Alternators. But occasionally *special requirements arise* which may be better served by American Electric's Revolving Field Alternators.

EXCITER REGULATING SYSTEM

Employs American Electric's trouble-free, direct-connected, high-cycle Inductor Alternator—which has no commutator, slip rings, brushes, springs, etc. Output is rectified and exciter-regulated by either electronic or magnetic amplifier means, then returned to the rotating field of the main alternator.



MANY MODELS

American Electric Revolving Field Alternators are available in STATIONARY and PORTABLE TYPES, open and totally enclosed models, for all laboratory, production and testing applications.

Write for details and quotations outlining requirements.

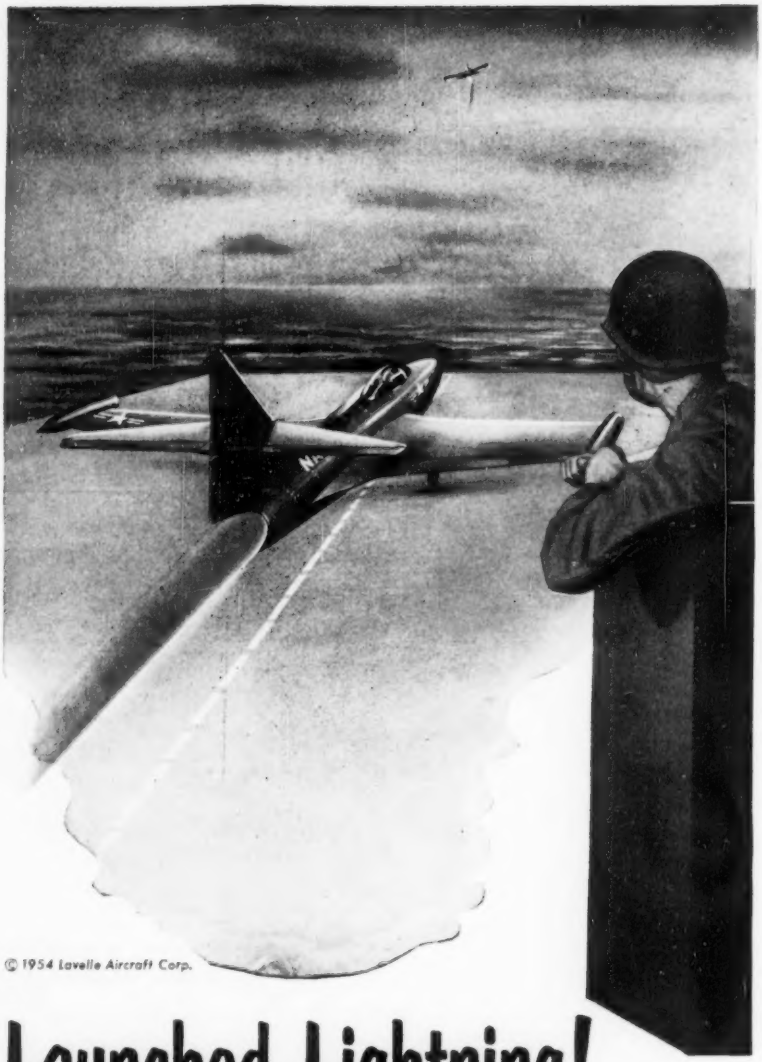
Also Manufacturers of High Frequency Inductor Alternators, Miniature Electric Motors, A.C. Industrial Motors, Motor Driven Blowers & Fans

AMERICAN ELECTRIC MOTORS
TRADE MARK

4811 Telegraph Road, Los Angeles 22, California

FIELD ENGINEERING REPRESENTATIVES:

TRAVCO ENGINEERING COMPANY—Silver Spring (Md.) • Boston • Buffalo • New York City • Chicago • Dallas • Kansas City • Wright Field • Minneapolis • Seattle • Montreal • Toronto • **JOE DAVIDSON & ASSOCIATES**, Los Angeles.



© 1954 Lavelle Aircraft Corp.

Launched Lightning!

Into the wind, into the dawn—with a scream and a trailing plume of flame—launched "lightning" takes to the sky. Today's jets on the flight deck and tomorrow's, still on the drawing boards, all must meet extraordinary performance standards. Every part is critical! Leading aircraft manufacturers know this and consider Lavelle their most reliable subcontractor for the fabrication of stainless steel and aluminum aircraft components.

Lavelle

LAVELLE AIRCRAFT CORPORATION, NEWTOWN, BUCKS COUNTY, PA.

■ BRITAIN

Rolls' newest turboprop venture, an engine in the 4,000-eshp. range. The Vickers 900 design hasn't been firmed up, as far as is known. BEA, which is interested, wants a high-wing configuration, but that depends on selling the idea to other (export) customers.

▶ **Bristol on Turboprops**—Down at Bristol, Dr. Stanley Hooker, head of Bristol's Engine Division, scoffs at those who see no future in a big turboprop. Hooker, master-mind of the 10,000-lb.-plus Bristol Olympus turbojet, is marrying his Olympus with his current Proteus turboprops to produce an 8,000-eshp. turboprop destined for the second generation of Britannias. He gives Edwards his 50-mph. lead on speed, but claims the great economics of the turboprop will make up for that. The Olympus-plus-Proteus turboprop will actually be rated less than 8,000 eshp. to give Hooker the ability to offer constant power from sea level to 25,000 ft.

As for complexity, Hooker claims that will go with time. He says that nothing like the money spent on researching turbojets has been devoted to researching turboprops. By 1958, when Hooker's new engine should be flying, he thinks turboprops will be a lot simpler.

▶ **Comet Successor**—Nothing is known of de Havilland's thinking about Comet 3 successors other than the fact that a design—or rather designs—exist. According to sales manager Frank Lloyd, DH will base its sales argument on a belief that there is and will be a place for "first-class" or luxury air transport. This will be the place for the admittedly more expensive turbojet.

From the meager data released on DH's powerful Gyron turbojet, it seems the company is putting simplicity and efficiency in turbojet design in the forefront. If turbojet economics can be made competitive, the Gyron or its derivatives may be the engine to watch.

If the pace of transport development in the U. K. is to be maintained, money must be found to keep all these projects alive. DH alone is saying now that it will use its own money to build a "Comet 4" prototype.

BOAC will probably underwrite the Britannia developments if the first Britannias turn out as well as they promise. And if mobility is to play any part in RAF thinking, money must eventually be granted to the beleaguered RAF Transport Command. Besides ordering the V-1000 prototype, RAF Transport Command has ordered only one new type of aircraft—20 Blackburn & General Beverley freighters.

DC-3 Replacements

In a minor key, several British companies this year will be touting private

control- when you need it!

Coming out of a power dive in a modern jet fighter taxes the skill of our finest pilots. These men must be able to count on the ready response of sure, sensitive controls. For that matter, controls must be dependable at all times—for takeoffs and landings as well as precision maneuvers in the air. That's why so many of these craft are equipped with Saginaw Ball Bearing Screw assemblies. Saginaw Screws can be supplied in a complete range of load and life requirements. They can be combined with electrical, hydraulic or pneumatic units to actuate retractable landing gears, ailerons, trim tabs, wing flaps and many other vital aircraft parts. Write today for our free engineering data book.

Saginaw Screws are also being used to improve performance in many products outside the field of aviation. To name a few: Feed mechanisms on double head grinders and heavy duty railroad car wheel lathes; control mechanisms on D.C. arc welders; actuators in the 4-way automobile seat adjusters; manual and power steering.

65

Saginaw STEERING GEAR DIVISION

GENERAL MOTORS CORPORATION, SAGINAW, MICHIGAN • MANUFACTURERS OF SAGINAW POWER STEERING

ELECTRICALLY HEATED

PITOT (AIRSPEED) TUBES

AERO INSTRUMENT CO.

5105 Denison Ave. Cleveland 2, Ohio

Manufacturers of electrically heated aircraft parts since 1925.

BRITAIN

ventures designed to do the work of the indestructible DC-3. Despite a torrent of pessimism about the market for DC-3 "replacements," British makers are going ahead with prototypes. They cite India and Africa as places for a new aircraft with limited capacity.

• **Handley Page,** with its H.P.R.-3, is furthest along. Two prototypes are building. The H.P.R. 3 is a piston engined aircraft—powered with four Alvis Leonides Majors. It will carry three tons, or 36-44 passengers, 1,500 miles at 220 mph.

• **Aviation Traders, Ltd.,** a large subcontractor, is entering the field with its Accountant, powered by two Rolls-Royce Dart turboprops. The Accountant has a maximum payload of 6,600 lb., can cruise at around 310 mph. for 920 miles. The aircraft is so arranged as to be able to carry 15 stretcher cases with attendants, 33 passengers, or two cars or equivalent freight. Prototype has just started.

• **Percival and English Electric** have comparable projects in the design stage, but no details are available. English Electric's design calls for an Armstrong Siddeley Double-Mamba turboprop installation. The company has applied to the British Air Registration Board for a ruling as to whether this could be considered equivalent to a twin-engined installation. ARB is impressed with the idea.

Helicopters

Rumor has it—and a well founded rumor it appears to be—that the three British services this year will finally place a quantity order (200 or so) for a British helicopter. If so, the only logical candidate is the Bristol 173.

• **Bristol**—The 173 is a 16-passenger copter with a still air range of 214 miles and a cruising speed of 138 mph. Its gross weight of 13,500 lb. is lifted by two three-bladed rotors powered by two Alvis Leonides Major engines. To relieve loads on the rotors during forward flight two sets of stub wings are mounted fore and aft on the fuselage.

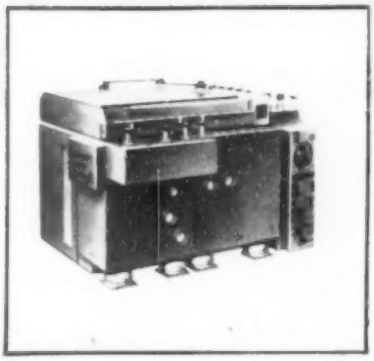
The 173 this year went through extensive tests on an aircraft carrier of the Royal Navy. At the time, its use as an anti-submarine weapon was suggested. British European Airways is using a few 171s to research its intercity helicopter plans in the U. K.

• **Fairey.** Most interesting helicopter research project in the U.K. is the Fairey Rotodyne jet. Still two years away from first flight, the Rotodyne will be the first to carry Britain's turbine tradition into the helicopter field. The prototype, underwritten by the Ministry of Supply, will be designed for 40 passengers and baggage and a cruising speed

HOW TO KICK OFF A ROCKET
in the right direction

...and FORD was asked to find the answer

Load! Aim! Launch! And off goes a rocket from shipboard . . . but not without precise devices that start the rocket in the right direction. Devices . . . such as Ford Instrument has manufactured for the Armed Forces since 1915. For from the vast engineering and production facilities of the Ford Instrument Company, come the mechanical, hydraulic, electro-mechanical, magnetic and electronic instruments that bring us our "tomorrows" today. Control problems of both Industry and the Military are Ford specialties.



14

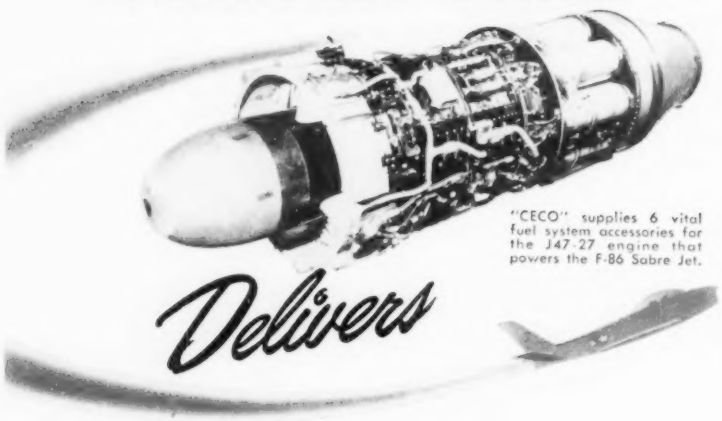
You can see why a job with Ford Instrument offers young engineers a challenge. If you can qualify, there may be a spot for you in automatic control development at Ford. Write for brochure about products or job opportunities. State your preference.

FORD

FORD INSTRUMENT COMPANY
DIVISION OF THE SPERRY CORPORATION
31-10 Thomson Avenue, Long Island City 1, N. Y.

When the Extraordinary is *Expected*

CHANDLER-EVANS



"CECO" supplies 6 vital fuel system accessories for the J47-27 engine that powers the F-86 Sabre Jet.

Delivers

Working in close cooperation with leading aircraft engine manufacturers, Chandler-Evans has developed fuel supply and regulation systems that have made possible many of the important "firsts" in aviation history.

Today, "CECO" developments are already paving the way to tomorrow's goals of still higher, faster flight.

The acknowledged superiority of "CECO" can make extraordinary performance a practical reality. Here is our address.

CECO

CHANDLER-EVANS
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONN., U.S.A.

■ BRITAIN

around 150 mph. It will be powered by two Napier Eland turboprops. Fairey is already thinking in terms of 60 passengers and cruising speeds up to 200 mph. for production versions. An interim project, the Gyrodyne, incorporating the Rotodyne's rotorhead, will fly shortly.

• **Westland.** Westland, with the Sikorsky license in the U.K., is building S-55s for the RAF and the British Army this year for the first time with British engines—Alvis Leonides Majors.

• **Saunders Roe** is marketing the little Skeeter helicopter, developed from Cierva, Ltd., patents.

• **Percival** has a helicopter project, called the P.74, designed to apply a gas generator to helicopter propulsion.

Naval Aviation

The Royal Navy this year will probably show off two new fighters:

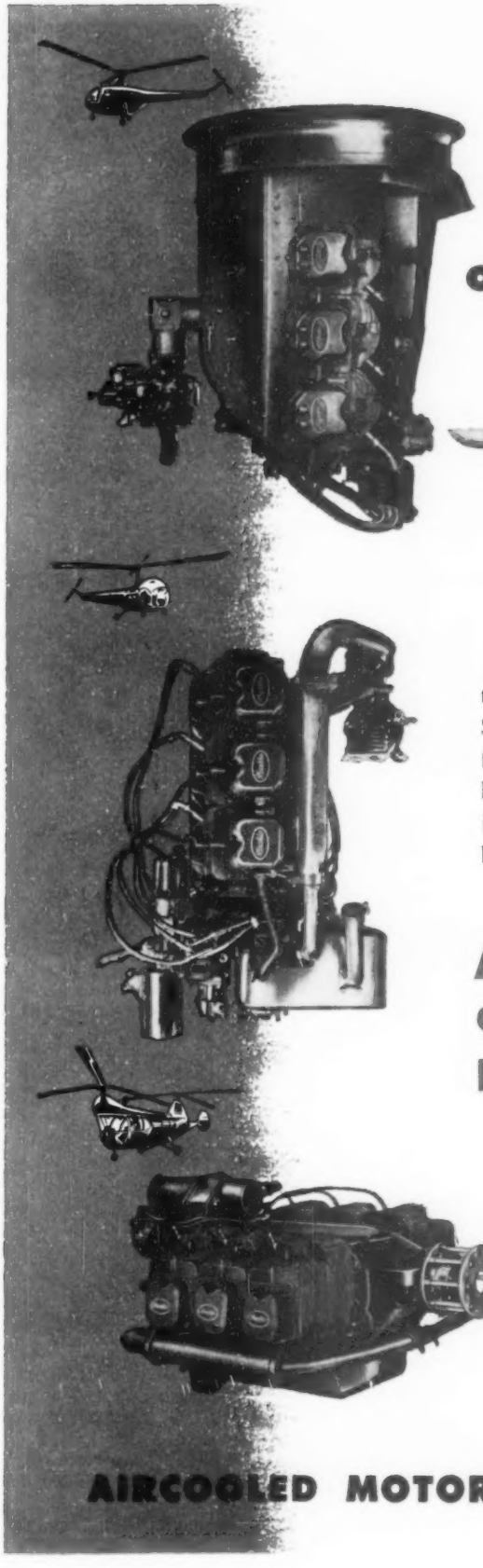
• **Vickers Supermarine** Division soon should announce first flight of the production version of the Vickers 508 twin-Avon fighter which appeared at Farnborough two years ago. Orders for the sweptwing fighter have been placed.

• **Appearance of the D.H. 110** in naval markings at Farnborough last year tipped off the future development of that all-weather fighter. DH is building more 110 prototypes with folding wings. Speculation has it that the production version will use the Gyron turbojet.

Last year the Navy's 17-month wonder, the Short Seamew, made its first appearance—17 months from design conception to first flight. Powered by an Armstrong Siddeley Mamba (it may have a Double Mamba someday), the Seamew is the forerunner of "light fighters" to come. It is designed for hunter-killer operations with NATO escort carriers. Because of its cheap construction, Short has high export hopes for the Seamew among NATO nations. Price: more than $140,000.

So far the Royal Navy has had less than good luck with its aircraft. Only last year did the Westland Wyvern fighter get into service, its Armstrong Siddeley Python turboprop having given great trouble with surging. No more than 50 were built. The RN's first jets, the Vickers Attackers, are already being supplemented with the very sleek but straight-winged Hawker Sea Hawks.

And the Navy's super-priority anti-submarine aircraft, the Fairey Gannett, has been coming and coming and coming for months and months and months. This year, it is confidently predicted, the Gannett will arrive in service about two years late. Half a dozen or more production models of the double-Mamba-powered fighters are flying now.



75%

of all the helicopters flying today have

Franklin POWER

Franklin engines power 4 out of the 5 CAA certificated helicopters under 400 h. p. — Bell, Hiller, Sikorsky and McCulloch. The production of these four manufacturers in the under 400 h. p. category has accounted for 75% or more of all the helicopters in the world, all powered by Franklin engines made by Aircooled Motors, Inc.

Aircooled Motors is also a major subcontractor of precision machining

The same men and plant responsible for the extraordinary success of Franklin helicopter engines can accept additional subcontract work similar to that long produced for major companies in the aircraft field. We are fully equipped for quantity production of precision machining and subassemblies of the highest quality. Your inquiries are invited.

AIRCOOLED MOTORS, INC., SYRACUSE, N.Y.

SE 5000 BAROUDEUR

Offshore Buying Props Ailing French Industry

By Ross Hazeltine

(McGraw-Hill World News)

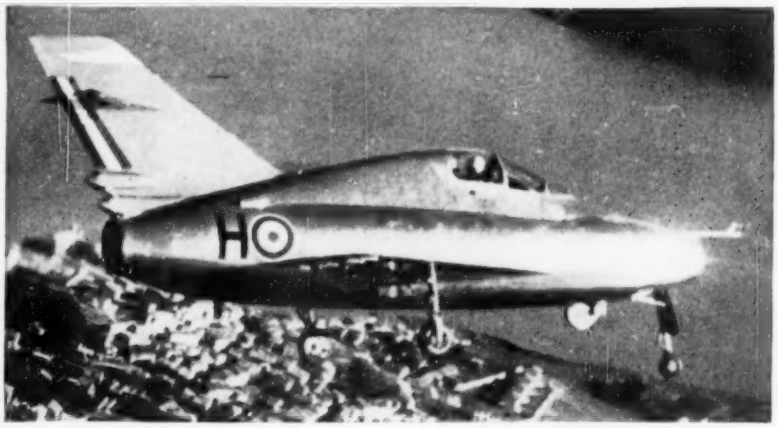
Paris—The French Air Force is fast growing into a major element in the defense of Western Europe. But this has not brought prosperity to French plane builders. On the contrary the aircraft construction industry has posted storm warnings of troubles it fears will affect the whole future of French aviation.

The buildup of the French Air Force during the last three years has been accomplished largely with American equipment delivered under the U. S. aid program. French industry has played a relatively minor role, and the industry's great problem today is simply lack of orders.

More than a year ago France launched a long-term program to replace American equipment in the FAF with planes designed and built in France. The U. S. has contributed importantly to this program with an $86-million offshore procurement order for Marcel Dassault's Mystere interceptor. But still the replacement program is proving a costly burden on the slim financial resources of the state.

▶ **Budget Gap**—Plane builders say Air Ministry orders for aircraft are too small and too subject to revision, postponement or cancelation to give the industry a chance of operating efficiently—or even maintaining its present facilities. Government officials reply that France has a chronically unbalanced budget and simply can't devote more funds to aircraft construction.

This gap between what the government can afford and what the aircraft industry needs is the basic problem of French aviation.



SFECMAS 1402 GERFAUT

DASSAULT MYSTERE IVB

Industry Potential

The French aircraft industry employs some 63,000 workers—33,000 in airframe construction, 16,000 in engine plants and 14,000 in aviation equipment. Measured by the numbers of workers employed, about two-thirds of the airframe and engine industries is nationalized.

If all the manufacturing facilities of the industry were fully utilized, it is esti-

THE NIGHT BEFORE THE PROXY FIGHT

Harrison Wells settled himself in the comfortable seat of the company's newly-overhauled plane — *his* company's plane, he reflected. His company, too, for that matter. He had built it, at the first, by single-handed effort. Now, he was flying home to do battle for its control.

This year, a new group of stockholders was challenging him. The show-down was set for tomorrow — 10 A.M. in the company's board room. Harrison Wells patted the sleek side of his brief case. He thought of the neat pack of proxies he had rounded up in a hurried, cross-continent tour of some 5,000 miles.

Make *him* the chairman of the board — kick *him* upstairs? Not *this* year! The plane flew steadily eastward.

Flights of this kind can be quickly planned and safely completed if engines are routinely rebuilt by Airwork. The personalized service and the engine exchange program offered by this unusual organization make possible factory-new performance for the privately-owned plane. Nowhere else, except in the shops of large, scheduled air lines, will you find such production-line techniques, equal to those of the original manufacturer.

Ask any of Airwork's 21 Class A dealers about their overhaul and supply services. You can depend on their ability and integrity.

DISTRIBUTORS FOR
PRATT & WHITNEY AIRCRAFT

Airwork CORPORATION

Millville, New Jersey

NEW YORK MIAMI WASHINGTON

Why You Should Use...
PAGE Automatic Welding Wire

PAGE Automatic Welding Wire is made to rigid specifications which provide consistent characteristics for smooth flow of metal during continuous or intermittent welding. There are many analyses for a wide range of uses.

for INERT GAS Welding PAGE Stainless Steel Wire is precision thread-wound on 25-lb. non-returnable convenient reels which fit popular arc welding machines. Six Page-Allegheny grades; wire diameters: .035″, .045″, .0625″.

for SUBMERGED ARC Welding PAGE stainless, low alloy, and carbon steel wire in layer-wound coils, in 22″ or 24″ mill coils, or on 200-lb. returnable steel reels. Wire diameters from 1/32″ to 5/16″; copper coated if desired.

Write to our Monessen, Pennsylvania, office for Bulletin DH-402

ACCO

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

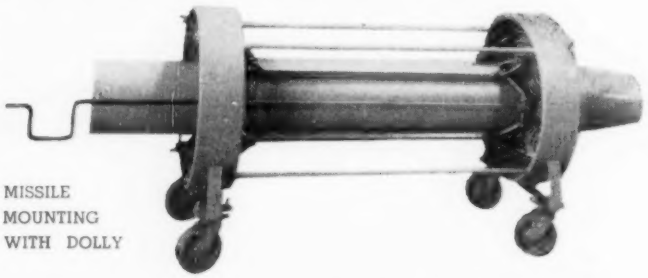
Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Portland, San Francisco, Bridgeport, Conn.

PAGE Welding Electrodes AND Rods

MECHANICAL SUSPENSION MOUNT CO.

DO YOU HAVE A PROBLEM IN MEETING THE LATEST ARMED FORCES "ENVIRONMENTAL" "VIBRATION" AND "SHOCK" SPECIFICATIONS?

This Mechanical Mount* has met these rigid requirements for guided missiles



MISSILE MOUNTING WITH DOLLY

Basic design lends itself to flexibility in sizes and weight of the sprung mass and functions in the 6 major planes with the lines of force, bisecting the C. G. of the sprung mass.—We welcome an opportunity to help solve your problem.—Our experience and facilities offer prototypes or production mounts for end or horizontal loading, for use with or without containers.

Write or phone for descriptive literature—Westbury 7-2886-7

* *Patented.*

MECHANICAL SUSPENSION MOUNT CO.

110 State Street, Westbury, L. I., N. Y.

■ FRANCE

mated that France could produce 1,200 to 1,400 fighter planes—like the Mystere or the F-86—each year. The industry claims it must have orders for 600 to 800 planes annually to achieve minimum efficiency. Prospects are not bright that more than half that minimum level of production can be attained.

► **Airlines Buy Little**—Commercial airlines have not to date been important buyers of French planes. A recent count showed that all European airlines owned a total of 615 planes. Of this total 58% were American, 38% were British and only 4% were French—12 four-engined Deux Ponts, three four-engine Sncaso Armagnac and 10 Sncaso two-engine Bretagnes.

French sales to airlines may pick up some in the near future. Air France has signed a contract to buy 24 Hurel Dubois H.D. 32s, a two-engined plane with a high-aspect-ratio wing, which is just now getting into production. Industry officials hope some foreign carriers, too, will place orders for the H.D. 32.

The French Air Force is now, and will remain for at least the next few years, the one big buyer of French-built planes. But FAF's capacity to buy is strictly limited by the general political and economic conditions which shape the national budget, and a close look at the present structure and organization of the FAF gives little reason for optimism.

French Air Force

About 3,000 planes of all types now carry the colors of the French Air Force. The French have about 500 planes in Indochina including four transport squadrons with DC-3s, five fighter squadrons with Bearcats, two light bomber squadrons with B-26s and one reconnaissance squadron.

In Europe and North Africa, France has a total of 38 squadrons equipped with F-84s, Dassault Ouragans and Sncase Mistrals (French version of British Vampire). All but eight of these squadrons are pledged to NATO and operate under the command of Allied Air Forces, Central Europe.

► **$800 Million to Spend**—To operate, equip and maintain this force the Air Ministry this year has a budget of $800 million (470 billion francs). Of this total about one-third, $250 million is for aircraft construction and is being spent principally for the production of four planes—the Mystere IV, Sncaso Vautour, Nord 2501, Fouga Magister.

• **Mystere IV**, equipped with a Verdon engine (Hispano-Suiza version of the Tay) developing 7,720 lb. thrust, will begin to go into squadron service in September of this year. The Verdon

HAPPY LANDINGS!

Next time you fasten your safety belt for a landing . . .
watch for that fragile moment when the big plane stops being airborne
and shifts its weight from wings to wheels. That's the moment when
OSTUCO heavy-wall tubing goes to work . . . supplying strength-without-weight
to such vital parts as axles, shock absorbers and landing gears.

If your aircraft product requires seamless tubing, formed or fabricated,
send us your blueprints for prompt quotation.

Latest edition of OSTUCO A-2 Handbook is yours upon request.

Always Specify Ostuco Tubing

ostuco AIRCRAFT TUBING

SEAMLESS AND ELECTRIC WELDED STEEL TUBING —Fabricating and Forging

OHIO SEAMLESS TUBE DIVISION
of Copperweld Steel Company • **SHELBY, OHIO**
Birthplace of the Seamless Steel Tube Industry in America

SALES OFFICES: BEVERLY HILLS • BIRMINGHAM • CHARLOTTE
CHICAGO • CLEVELAND • DAYTON • DETROIT • HOUSTON
LOUISVILLE • MOLINE • NEW YORK • PHILADELPHIA
PITTSBURGH • SALT LAKE CITY • ST. PAUL • SEATTLE
SYRACUSE • TULSA • WICHITA

CANADA, RAILWAY & POWER CORP., LTD.

EXPORT: COPPERWELD STEEL INTERNATIONAL COMPANY
117 Liberty Street, New York 6, New York

INTRODUCING...

the new

TURBO zone-40

manufactured to meet the requirements of

MIL-I-7444A

A vinyl plastic tubing that combines fungus resistance with exceptional low temperature characteristics to provide outstanding electrical protection. This TURBO-ZONE-40 is highly resistant to heat . . . cold . . . fungus . . . moisture . . . and has long enduring aging characteristics, plus 5 superior features:

COLD IMPACT — down to −90°F (−67°C)

FLAME RETARDANT — meets all the specifications under Code MIL-I-631B

ELONGATION — highly flexible for snaking operations

TENSILE STRENGTH — 1800 P.S.I. — gives rugged durability

TRANSPARENCY — sufficient to permit ready identification of color coding

TURBO BRAND

TURBO-105 High dielectric and physical properties . . . excellent for high operating temperatures.

Sizes 5/8" I.D. to 1½" I.D. Inclusive

TURBOLEX "63" & "85" General purpose tubing—extremely flexible—good dielectric properties.

TURBOTRANS-105 Specially processed for potting and baking operations —oil resistant—high heat resistance.

Insulating Material TURBO Specialists Since 1920

THE WILLIAM BRAND & CO., INC.

Dept. A3-15 Willimantic, Conn., U.S.A., Tel. HArrison 3-1661

TURBOTUF Insulating Tubing and Sleeving · TURBO Insulated Wires · Wire Markers · Extruded Tubing · Varnished Saturated Sleeving and Tubing · Cambric Cloths, Tapes, Papers · Mica · Harnesses

SALES REPRESENTATIVES IN PRINCIPAL CITIES

■ FRANCE

engine later will be replaced by an axial-flow Atar 101E built by the nationalized company Snecma. This engine will develop about 7,500 lb. thrust and an afterburner will add about 20%. This version of the plane is called the Mystere IV-B and is expected to go into squadron service in about two years.

• **Vautour.** The 1954 budget also provides funds for the construction of 79 Sncaso Vautours, a two-engine ground support plane. The Vautour will have Atar 101B engines with 5,280 lb. thrust, which give it enough speed to crack through the sonic barrier in a shallow dive. The first Vautours will begin to go into squadron service about the middle of 1956. The present Vautour order is considered only a first slice and will be supplemented with funds to be provided in future budgets. The French also hope the Vautour will attract attention abroad. They point out that within the NATO air forces only the American B-26 and the British Canberra are designed for light bombing and ground support missions of the type the Vautour will specialize in.

• **Nord 2501.** The third plane in production is the Nord 2501, a two-engine transport. The Air Ministry has placed a new order for 60 of these planes. Production of this plane is now six or seven a month, and the first of them will begin to go into squadron service within a few months.

The French believe the Nord 2501 is particularly well-suited for use as a tactical transport in Indo China. It can carry seven tons over distances less than 600 miles, and its configuration makes it suitable for dropping heavy loads by parachute.

• **Magister.** A fourth plane, the Fouga Magister, will go into production this year. The Magister is an advanced trainer powered by two Turbomeca Marbore engines with 880 lb. thrust. A total of 100 of these planes have been ordered, and deliveries will begin in about 18 months.

► **New Candidates**—Two other French military planes—the Baroudeur and the Trident—now still in the testing stage, have shown promise and may be produced with next year's funds.

• **The Sncase Baroudeur,** powered by an Atar 101C with 6,160 lb. thrust, takes off with rocket assist from a tubular steel carirage and lands on skids. Tests so far have given better than expected results. The Baroudeur can land on ordinary plowed ground, on a sandy beach or on grass. A pre-production series of five has been ordered.

• **The Sncaso Trident** is the other prototype being tested. The Trident is a small light plane designed for the defense of small, critical areas. It is powered by two Turbomeca Marbore en-

INDIANA GEAR

Aircraft specialists in...

GEAR SHAPING
GEAR GRINDING
GEAR CUTTING
GEAR HOBBING
DRILL PRESS (RADIAL & POWER FED)
HORIZONTAL BORING
BROACHING
INTERNAL GRINDING
EXTERNAL GRINDING
LATHE WORK (TURRET & ENGINE)
HEAT TREATING
METALLURGY
ROTOBLAST
GUN DRILLING
MILLING
TAPPING
NITAL ETCH
AF APPROVED INSPECTION
ZYGLO
MAGNAFLUX
X-RAY EXAMINING
PARKO LUBRIZE
DICHROMATE
DULITE
COPPERPLATE
CADMIUM PLATE
VAPORBLAST
SPRAY PAINTING & BAKING
ASSEMBLY
DESIGN ENGINEERING

Our complete facilities brochure available on request

INDIANA GEAR

INDIANA GEAR WORKS, INC., INDIANAPOLIS 7, IND.

■ FRANCE

gines with 880 lb. thrust each, and carries tail rockets which are expected to raise its top speed to Mach 1.6. The plane probably will make its first flight with rocket power next spring.

The Future

These planes are the newest weapons in the arsenal of French airpower. With the funds available to them, French airmen figure they can bring these new planes into service at the rate of about 300 a year. That is about all the nation's economy will allow, and it is also about all that is needed to maintain the FAF at its present level.

But this figure represents only one-third to one-fourth of the present production capacity of the French aircraft construction industry. So unless exports and sales to French airlines can be greatly increased, the industry is in for bad times which will force reorganization of the nationalized companies and a big reduction in industry capacity.

► **Three Plants Down**—First steps in the direction already have been taken. Within the last six months three important aircraft plants have been closed permanently. Sncan was forced to close two of its six factories, and Morane-Saulnier shut down one plant.

The industry, naturally, is doing its best to resist this trend. With government support it has organized a committee to study foreign markets, arrange exhibitions of French planes abroad and advise French manufacturers on export sales techniques. It also is urging larger appropriations for aircraft construction and the imposition of some limitations on purchase of foreign planes by French airlines.

But nowhere in the industry is there any great optimism that these efforts can succeed fully enough to solve the problem. The U.S. government could solve the problem by greatly increasing its offshore procurement orders and supplying French planes to other Allied nations.

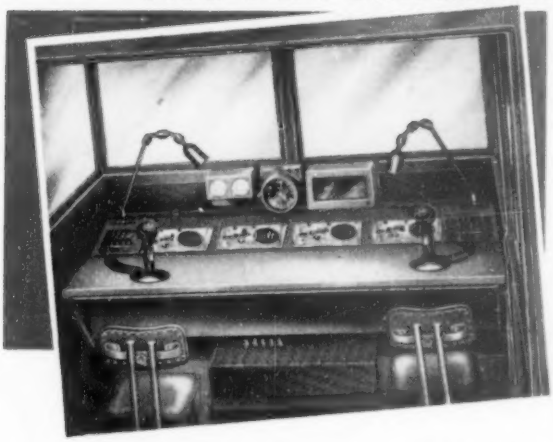
► **Salvation in EDC?**—The brightest hope for the future of the French aircraft industry rests with the projected European Defense Community. If the EDC treaty should be ratified this spring, the French believe it will open to them a big and profitable new market. Of the six EDC nations—France, Germany, Italy, Belgium, the Netherlands and Luxembourg—only France has in existence now a big, skilled and equipped aircraft construction industry.

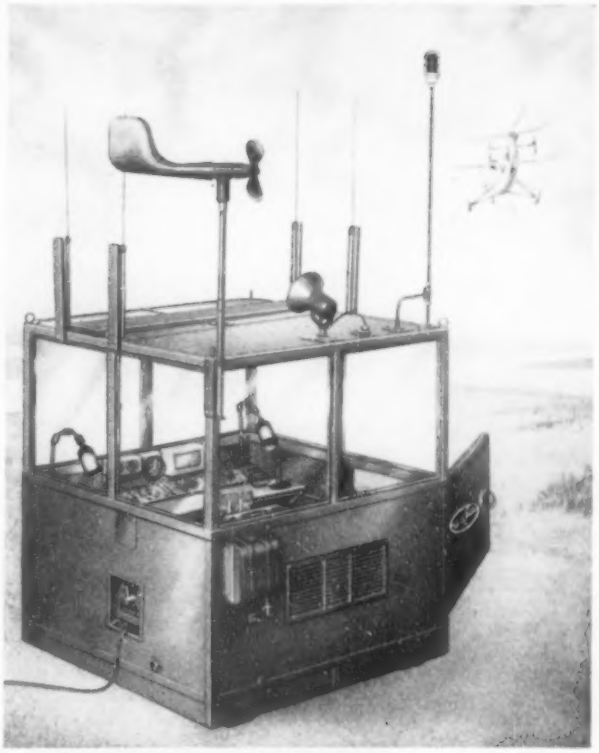
To French airmen it will be bitter irony if nationalistic opposition to EDC in the French national assembly succeeds in killing the treaty, and so strikes the blow that may well knock out half the industry's present capacity.

Wickes

CONTROL TOWERS AND CONSOLES COMMUNICATIONS SYSTEMS for AIR TRAFFIC CONTROL

TYPE T-2 *PORTABLE* AIRPORT CONTROL TOWER



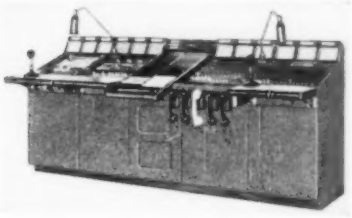


A complete airport control tower, transportable by helicopter or truck. Includes radiotelephone transmitting and receiving equipment, aerological instruments, and provisions for field telephones. Control facilities for two operators. Air conditioner and heater.

APPLICATION. For permanent or emergency use. Set up and operated anywhere – within minutes. Maintains air-ground communication, and controls available field lighting equipment.

Write for illustrated brochure.

COMMUNICATIONS CONTROL SYSTEMS



Wickes is a pioneer in the field of integrated communications control systems for airport use. A wide variety of consoles are manufactured, to provide radiotelephone transmitting and receiving facilities, aerological indicators, field lighting control and facsimile display, interphone communication, crash-alarm signaling message recording control facilities, and flight progress data.

CUSTOM-BUILT CABINETS

Cabinets to house your equipment designed and built to your specifications. Let our experience solve your cabinet problems.

Wickes will design and build to your order complete communications systems for air traffic control. Your inquiries are invited.

Wickes ENGINEERING AND CONSTRUCTION COMPANY

ESTABLISHED 1920

12TH STREET AND FERRY AVENUE CAMDEN 4, NEW JERSEY

AVRO CANADA CF-100 CANUCK

Airpower in the North

Canada Rushes Defense Net, Aids NATO

Lion's share of defense funds goes to RCAF expansion in Canada and abroad; aircraft and engine production is small but growing.

Toronto—Largest slice of Canadian defense expenditures in the past few years has been for the Royal Canadian Air Force.

Results of this policy are now visible with a number of RCAF squadrons on active duty at bases in Great Britain, France and West Germany, with progress being made on the Canadian continental defense system, establishment of first domestically based Canadian jet fighter squadrons, and completion of a number of large training and supply bases across Canada.

Industrially the results of the policy are also noticeable with jet aircraft and engines coming off assembly lines at plants in eastern Canada and new jet aircraft being ordered.

RCAF

Although few details have been released, the RCAF reports progress in the past year on the early warning and ground control system for continental defense. Some of the units were in operation late in 1952, and construction work on other units was completed at end of 1953. Radar system is operated jointly by RCAF and U.S. air services throughout northern Canada.

Canada is also planning to develop a new system of radar warning developed at McGill University, a system which is cheaper in manpower and equipment than the conventional radar warning system now shared with U.S.

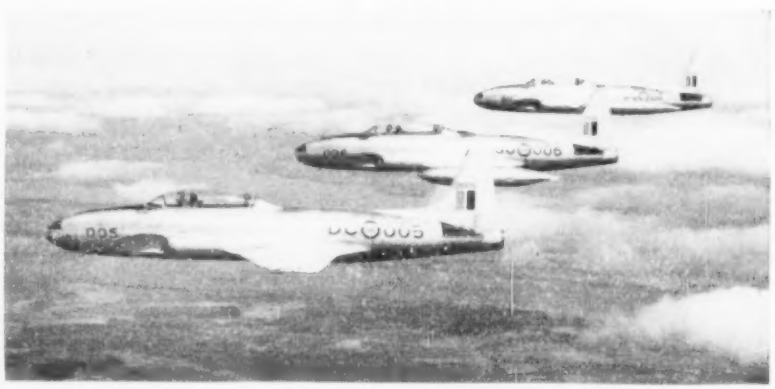
RCAF during the past year opened ground observer filter centers across Canada, as part of its continental defense establishment. First Canadian-based jet fighter squadrons using the Canadian-made and -designed CF-100 twin-engine jet fighter were established in 1953 at North Bay, Ontario, along with a training base for crews for these aircraft. A number of other Canadian bases are being equipped with CF-100 aircraft.

▶ **Contribution to NATO**—Overseas, Canada now has 12 Sabre-equipped squadrons, based at Langar and North Luffenham in England, at Metz and Marville in France, and at Zweibrucken and Baden-Soellingen in Western Germany. These are part of Canada's contribution to NATO. Canadian air staff overseas includes both men and women. Practically all aircraft used in the overseas squadrons were flown over during 1953.

Canadian air forces took part in a number of operations with the USAF in north Atlantic and northern Canadian areas during the past year, perfecting the joint operation. The RCAF also developed its coastal squadrons, its air transport service, and its search and rescue groups; it took delivery in 1953 of two British de Havilland Comet jet transports for its Transport Command, the first Comets to be used on this continent.

▶ **Bases and Men**—Numerous new bases were built or started during the past year as part of RCAF's $400-million construction program. These included two huge supply and overhaul bases outside Toronto and Edmonton, as well as permanent buildings for personnel and new hangars for larger aircraft. Runways were extended at many airports for jet fighters, and training bases were completed.

The first T-33 Silver Star jet trainers made in Canada by Canadair, Ltd., Montreal, were delivered to training bases. Aircrew trainees from nine countries are now undergoing training at Canadian bases, Portuguese and Turk-



CANADAIR T-33A SILVER STARS

New Fenwal Overheat Detectors Guard Eastern's New Super-C Constellations

1. WINTER TO SUMMER in three hours and forty-five minutes is a "regularly scheduled" feat of Eastern Air Lines on its New York-Miami run. Its new Super-C Constellation is the last word in luxury travel and dependability. Among its advanced features is a new "right-angle" fire and overheat detector for the utmost in protection on this blue-ribbon transport.

2. EASE OF INSTALLATION is a feature of all Fenwal Overheat Detectors. Shown, is a two-terminal, hermetically sealed unit being installed on Eastern Airlines' latest transport. Many of America's leading aircraft operators have standardized on Fenwal Detectors after exhaustive tests and experience in severe environmental and operational conditions.

3. X-RAY INSPECTION is one of many tests for quality-control and accuracy to which individual THERMOSWITCH units are subjected at Fenwal Incorporated. Precise inspection matches and protects modern mass-production methods which are making Fenwal temperature control and detection devices preferred throughout industry for the dual qualities of absolute dependability and reasonable price.

4. HERE THEY ARE. Fenwal two-terminal Overheat Detectors in two designs — same performance characteristics. The right-angle model was developed for use in confined space. Temperature-sensitive outer shell is the actuating element, causing internal contact to function the instant surrounding air reaches alarm point. They comply fully with C.A.A. and SAE requirements. For complete data write Fenwal Incorporated, 123 Pleasant Street, Ashland, Massachusetts.

Fenwal

THERMOSWITCH®

Electric Temperature Control and Detection Devices

SENSITIVE... *but only to heat*

Bendix
DIGITAL
DIFFERENTIAL
ANALYZER

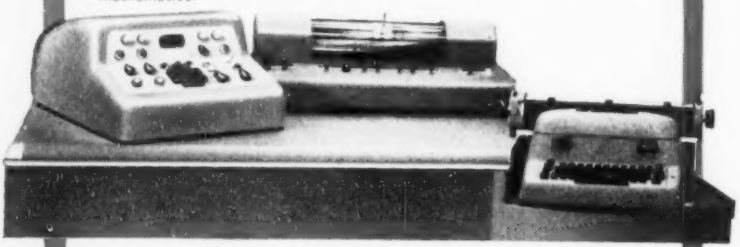
MODEL D-12

HIGH SPEED • ACCURATE • MODERATELY PRICED

Mathematical versatility and simplicity of operation are noteworthy features of the Bendix Model D-12 Electronic Computer.

This Digital Differential Analyzer will solve the most complicated engineering problems quickly and precisely. The decimal numbering system is used exclusively in both programming operations and in machine calculations. Operators are easily and quickly trained.

Model D-12 is the ideal machine for the solution of complex problems in the fields of aerodynamics, optics, chemistry and analytical mathematics.



The Bendix Computer gives you high speed numerical solutions to—

1. Linear and non-linear differential equations.
2. Simultaneous sets of such equations.
3. Integral equations.
4. Split-boundary value problems.
5. Individual or simultaneous sets of linear or non-linear algebraic and transcendental equations.
6. Numerical simulation of certain physical phenomena.

For complete information please write for Brochure No. 2-2.

Bendix Computer

DIVISION OF BENDIX AVIATION CORPORATION
5630 Arbor Vitae St., Los Angeles 45, Calif.

■ CANADA

ish trainees joining those of Great Britain, Norway, Denmark, the Netherlands, Belgium, France and Italy in 1953.

As part of its continental defense plans, RCAF this past year began training personnel in ground defense in case of paratroop or other enemy attacks on local airfields.

Recruiting was reported as continuing steadily throughout 1953. Estimated strength at end of 1953 was 43,000 officers and men, about 5,000 more than at end of 1952.

Production

As 1953 ended the Canadian government announced plans for new orders for new aircraft being placed with Canadian aircraft companies, thus making the decision to keep the Canadian aircraft manufacturing industry in active operation. Canadian aircraft plants during 1953 made aircraft not only for the Canadian military services, but also for those of the U. S. and other countries of the North Atlantic Treaty Organization.

▶ **$400-Million From Aviation**—The aviation manufacturing industry in 1953 accounted for about three-quarters of the entire revenue from aviation in Canada.

In 1952, aviation ranked ninth among Canadian industries, and last year set a new peacetime record amounting to about $400 million. Of this, over $300 million was accounted for by manufacturers of aircraft and components, and repair and overhaul services, according to estimates of the Air Industries and Transport Assn. of Canada.

Bulk of the $300 million revenue was for defense work, including payments on contracts totaling $504 million let in 1952.

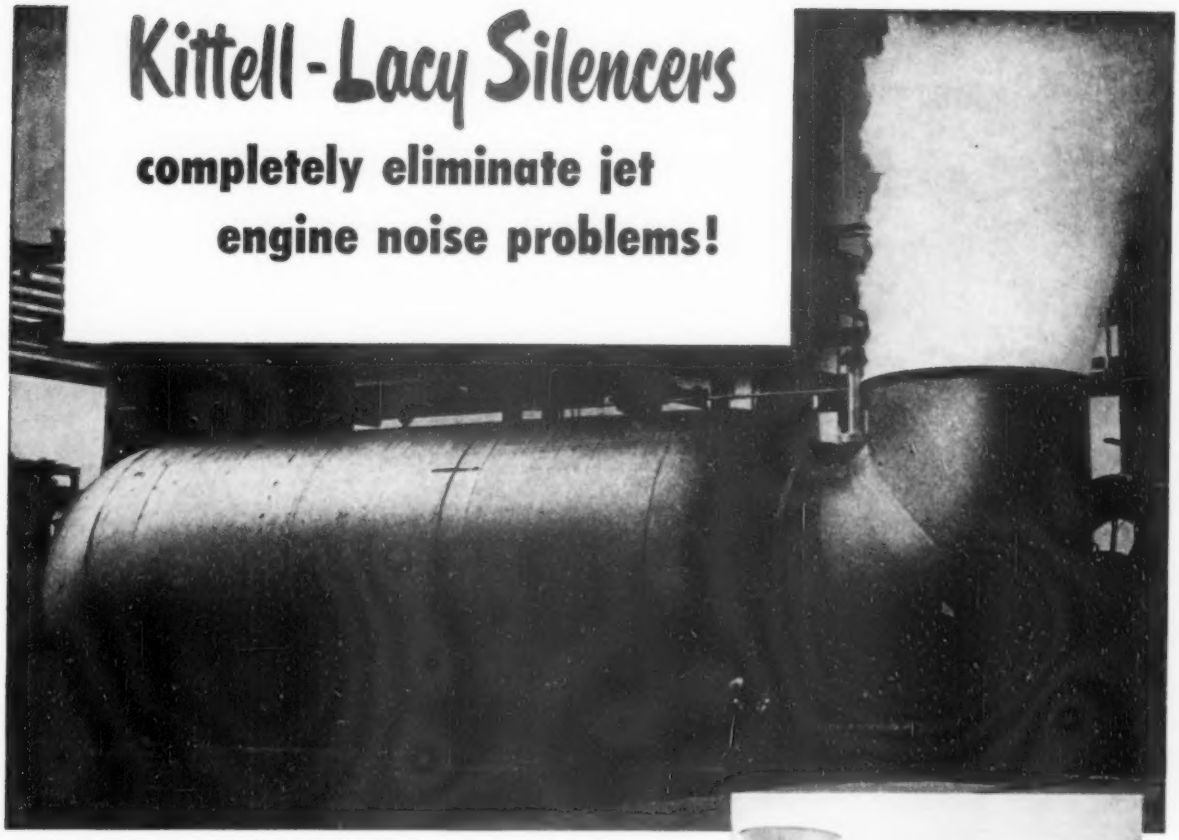
▶ **New Planes**—At year-end the government announced plans to produce a new fast fighter, the CF-105, by A. V. Roe Canada Ltd. This delta-wing aircraft is expected to have a speed of 1,200 mph. a range of 1,500 mi., to be armed with rocket missiles, and to have two new jet engines to be made by A. V. Roe Canada. A prototype is to be ready by about end of 1955.

The other new plane to be produced is the Grumman S2F antisubmarine aircraft, which will be made under license in Canada by de Havilland Aircraft of Canada, Ltd., mainly for the Royal Canadian Navy. Orders are expected to be placed for 100 of the aircraft to start, with 150 more at a later date, according to unofficial estimates.

Slated for early production in Canada is the British Bristol Britannia for

Kittell-Lacy Silencers

completely eliminate jet engine noise problems!



Stop neighborhood complaints... improve personnel efficiency and morale!

Kittell-Lacy Silencers reduce the ear-shattering noise accompanying ground testing of jet engines to an acceptable level. Operation is so quiet tests can be conducted *day and night* without complaints from surrounding residential areas. Operating personnel benefit, too, since reducing the noise level safeguards hearing, lessens fatigue, and increases efficiency!

Put Kittell-Lacy's experience to work for you!

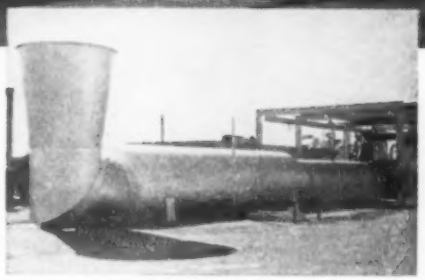
Kittell-Lacy engineers, specialists in acoustic and structural engineering, were pioneers in developing sound abatement facilities *specifically for silencing jet engines.* They have designed, fabricated and installed some of the largest silencers now in use. Many of these are in continuous operation at extremely high temperatures, yet have required *no maintenance other than routine exterior painting.*

If you want to know more about Kittell-Lacy facilities and experience, a new informative brochure is yours for the asking. Write for it today.

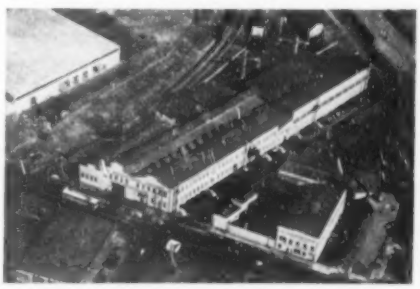
Silencers • Silencer Accessories • Acoustical Panels

KITTELL·LACY, INC.

915 SOUTH SANTA FE AVENUE LOS ANGELES 21, CALIFORNIA



Unique sliding "dog house" on this 7'6" I.D., Kittell-Lacy silencer permits easy positioning of engine on test stand.



66 years of heavy steel fabrication experience!

Kittell-Lacy's extensive manufacturing facilities and personnel experienced in fabrication and installation of heavy steel structures assure good construction.

Third International
AVIATION TRADE SHOW

May 5, 6, 7, 1954

71st Regiment Armory
Park Avenue at 34th St.
New York City

●

Aviation today is a twenty-billion dollar industry, demanding machinery, tools, metals, electronics, electrical devices, fuel, lubricants, handling equipment, packaging, plastics . . . virtually every product produced by modern industry.

THE MOST EFFECTIVE SINGLE MEANS OF PLACING YOUR PRODUCT AND YOUR COMPANY BEFORE THIS VITAL INDUSTRY IS PARTICIPATION IN THE THIRD INTERNATIONAL AVIATION TRADE SHOW.

The only business show in this giant industry, the annual International Aviation Trade Show brings to you the key personnel of aviation. It enables you to meet personally the engineers, production and purchasing men who make the decision. It affords you the opportunity to introduce new products, strengthen your sales efforts, increase your volume.

●

For details and tickets, write

Dept. N

Aircraft Trade Shows, Inc.

Hotel McAlpin, New York 1 NY

PE 6-5933 or PE 6-5700

Cable: Airshows

■ CANADA

CANADAIR F-86E SABRES

RCAF. This is to be made by Canadair, Ltd., with certain modifications from the commercial Britannia made in Great Britain, including, it is said, a new wing, elongated main fuselage, redesigned tail assembly and use of U.S.-built Wright engines. A prototype will probably be built this year, with an order for 50 of the aircraft expected initially.

▶ **Manufacturing Lineup**—Canada's aviation manufacturing industry is still small. Four companies are building aircraft, three are making engines, and about a dozen are the principal overhaul and component manufacturing firms in the country. There are several hundred smaller companies and plants, whose main business is not the aviation industry, making components and parts for the manufacturing plants.

Most of the industry is centered in eastern and central Canada, and is controlled by Britsh or American parent companies.

• **A. V. Roe Canada, Ltd.,** is located at Malton, Ontario, a suburb of Toronto, and has about 10,000 people working in the aircraft plant, another 5,000 in its jet engine plant. Currently Avro is building the CF-100 Mark 4 for the RCAF in undisclosed numbers, as well as the Orenda jet engine for both the CF-100 and the Sabre F-86E being built at Canadair. Orders have been completed on the CF-100 Mark 3, which has been equipped with rocket missiles.

Research work is being done at the plant on advanced type aircraft, including what is believed to be a "flying saucer" type of gyroscopic jet-powered single seater fighter. No official information is available on this research job which is very hush-hush at the plant and in government circles.

Work is also progressing on new jet engines to power the new delta-wing CF-105, while production of the Orenda engine is on schedule. No figures have at any time been released as to production of the Orenda engines since the early stages of its production.

• **De Havilland,** at Downsview, another suburb of Toronto, is continuing with production of its single-engine Beaver and Otter aircraft. The Beaver was used by the U.S. in Korea and other

Major Canadian Aviation Plants

	Floor Space (sq. ft.)*	Employes*
AIRCRAFT		
A. V. Roe Canada Ltd. Toronto	1,500,000	10,000
Canadair Ltd. Montreal	2,000,000	11,000
Canadian Car & Foundry Co. Ltd. Fort William, Ont.	700,000	1,600
De Havilland Aircraft of Canada Ltd. Toronto	600,000	2,000
ENGINES		
A. V. Roe Canada Ltd. Toronto	1,000,000	5,000
Pratt & Whitney Aircraft Ltd. Montreal	350,000	1,200
Rolls-Royce of Canada Ltd. Montreal	60,000	400

* As of December 1953.

Where's "Charlie"?

The "bird" will find him!

As it rockets along at supersonic speeds—high above the earth—its guidance system directs it unerringly to target "Charlie."

Electronics makes today's accurate missile guidance a reality—and *electronics* is the past, present and future of RCA.

For years, RCA has been working with the Armed Forces on design and engineering of more accurate, more effective missile-guidance systems. The same RCA engineering facilities—from original planning to final production stages—are available for development of complete electronic systems of all kinds. For additional information, write to Government Section, Engineering Products Division, Radio Corporation of America, Camden, N. J.

RCA®

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DIVISION CAMDEN, N.J.

NEW

AMPHENOL Components

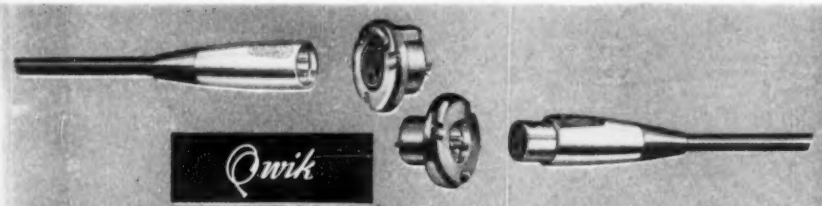
stamped with the quality trademark—

AMPHENOL

miniature

165 Series

The new AMPHENOL 165 series miniature AN-type connectors average about ⅓ the weight of standard ANs but retain the many features initiated by AMPHENOL in the larger connectors. The 165 series are the latest AMPHENOL contribution to the continuing program of miniaturization of components for instrumentation.



Qwik

microphone connectors

AMPHENOL QWIK Microphone Connectors are the newest, the most efficient and certainly the most attractive connectors ever offered for audio applications. They are available in 3 or 4 contacts and feature tough construction coupled with fine materials. Contacts are plated with gold over silver finished bronze.

aljak cable

ALJAK coaxial cable has been designed by AMPHENOL to permit a wider scope to cable applications in critical electronic equipment. Waterproof and semi-flexible, ALJAK is made with a tough aluminum jacket over extruded Teflon or polyethylene dielectric. The cable has very low attenuation as well as a smaller o.d. than equivalent RG type cables.

For further information about all of these AMPHENOL *components write and request the special literature which has been prepared.*

AMERICAN PHENOLIC CORPORATION

chicago 50, AMPHENOL *illinois*

■ CANADA

locations as the L-20. In the fiscal 1953, ending last Sept. 30, the company delivered 181 Beavers and 16 Otters, the latter for the RCAF. A total of 555 Beavers had been sold since the company began production of this postwar-designed Canadian freighter. It is now being used in 29 different countries, including the Falkland Islands where the 500th aircraft is in use.

Most of the Beavers are equipped with Pratt & Whitney engines, but for sterling currency countries a new Beaver was produced in 1953 powered with the British Alvis Leonides engine. Sales for 1953 totaled about $15 million.

De Havilland Aircraft of Canada also sells and services the British de Havilland Dove airliner, the de Havilland Comet jet airliner, the de Havilland Ghost jet engines which power the Comet, and overhauls a number of RCAF aircraft and the General Electric J-47 jet engine.

• **Canadair, Ltd.,** is the major aircraft plant at Montreal. American-owned, Canadair is building the Sabre F-86E and the T-33 Silver Star jet trainer. It is reported that about 1,000 Sabres were produced by late 1953 for Canada, Great Britain and the U.S.

Definite orders for civilian aircraft are being sought, but none are at present known to be headed for production. The company services and overhauls the North Star DC-4M, with which it started postwar production for the RCAF and Trans-Canada Air Lines. While present plans call for possible production of the Bristol Britannia under license for the RCAF as a transport, there is likelihood that this aircraft may also be produced for civilian purposes at this plant.

• **Pratt & Whitney and Rolls-Royce** at Montreal are building aircraft engines. The former is building aircraft engines for the Harvard trainer, and Rolls-Royce is building Nene turbojet engines for the T-33 jet trainer.

• **Canadian Car & Foundry,** at Fort William, Ontario, at western end of Lake Superior, is completing an order for Harvard trainers, and was building components for the T-36 trainer when that order was canceled in the latter part of 1953. It may start production of another trainer for the U.S. government.

These are the major aircraft and engine manufacturing plants in Canada. Together they employ about 31,000 people, and form the nucleus for a larger aircraft manufacturing industry in Canada.

Civil Transport

This year Canadian airlines will use larger and faster aircraft, start domestic

ONLY GILFILLAN HAS PROVEN GAP-FILLER RADAR NOW

IF HOURS WERE MILES

During the entire year of 1953, Gilfillan Surveillance Radar was "on guard" 24 hours a day—8750 hours—at Boston International Airport with only 7⅓ hours of involuntary outage. This is less than 1/10 of 1%! If hours were miles, this would be the equivalent of the short distance from Boston Commons to Boston Airport compared to the vast stretch of air miles lying between Los Angeles, Boston and Moscow.

This example is only one of the many instances of the remarkable 4-year dependability record of *perfected* Gilfillan Surveillance Radar when combined with *outstanding* maintenance by CAA personnel at major U. S. airports.

Reliable air defense requires reliable radar. Gilfillan is the *only* gap-filler radar now available that has already made the long jump from prototype to *proven performance.*

Gilfillan has *developed* and *delivered* more ground surveillance radar than all other manufacturers. The proven dependability of this perfected equipment is *now* demonstrating itself—at this moment and 24 hours every day—at more than 200 air bases and airports around the world.

GCA RADAR AND ELECTRONICS

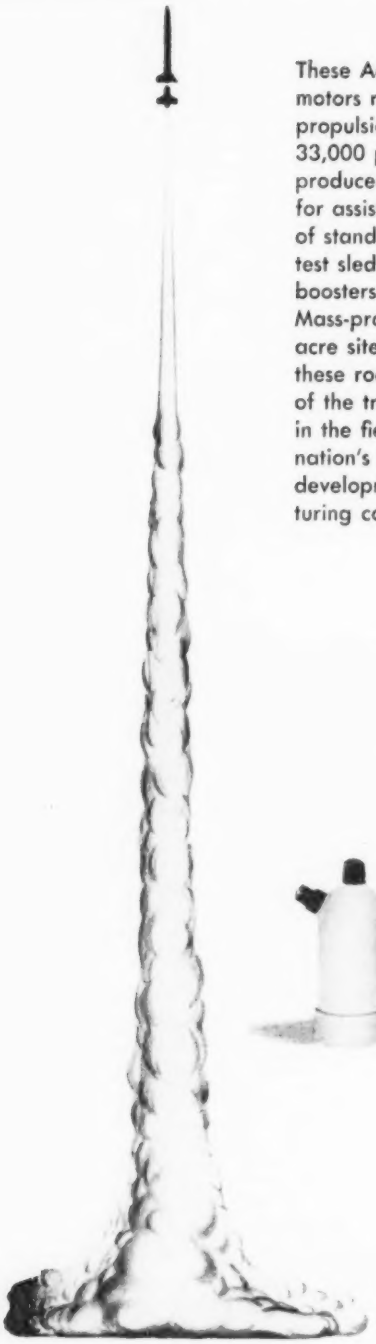
Gilfillan

LOS ANGELES

GCA

AROUND THE WORLD

REGULAR OR KING SIZE?



These Aerojet-General solid-propellant rocket motors represent the solution to a multitude of propulsion problems. Ranging in size from 250 to 33,000 pounds thrust, they were developed and produced by Aerojet-General to fulfill the needs for assisted-takeoff of piloted aircraft, for a source of standby power, for propelling high-speed test sleds, and for high-thrust, short-duration boosters for sounding rockets and missiles. Mass-produced at Aerojet-General's 8400-acre site near Sacramento, California, these rocket motors are another indication of the tremendous advancement made in the field of rocket power by the nation's leading rocket research, development and manufacturing company.

COMPLETE, MODERN RESEARCH AND TEST FACILITIES
AND
COMPLETE, VERSATILE MANUFACTURING FACILITIES

LIQUID- AND SOLID-PROPELLANT ROCKET ENGINES FOR ASSISTED-TAKEOFF AND MISSILES • AUXILIARY POWER UNITS AND GAS GENERATORS • ORDNANCE ROCKETS • GUIDANCE AND CONTROLS • ELECTRONICS AND SPECIALIZED AVIONICS • UNDERWATER PROPULSION DEVICES • ARCHITECT-ENGINEER SERVICES

Aerojet-General CORPORATION
A SUBSIDIARY OF THE GENERAL TIRE & RUBBER COMPANY

THE GENERAL TIRE

AZUSA, CALIFORNIA • CINCINNATI, OHIO • SACRAMENTO, CALIFORNIA

■ CANADA

air tourist services, inaugurate new domestic and international routes and begin all-express and all-freight services with specially built cargo airliners. In 1953 Canadian airlines expanded their operations both at home and internationally and waged a major battle to break government monopoly of certain domestic air services.

▶ **New and Faster**—Both government-owned and privately owned airlines will have new and faster aircraft in use in 1954.

• **Trans-Canada Air Lines,** government-owned service, is starting new daily transcontinental services later this year with Lockheed Super Constellations, eight of which have been ordered. Some of these will be used on TCA's trans-Atlantic service which now uses Canadian-made North Star DC-4M aircraft in tourist-rate service.

TCA will also take delivery later this year of the first British Vickers Viscount turboprop aircraft to be used on this continent, for use on heavily traveled Montreal-Toronto services, Montreal and Toronto services to New York, Toronto services to Cleveland and Chicago.

For cargo service, TCA early this year began using British Bristol Freighters, three of which were ordered. Air cargo rates were reduced by 30% at beginning of 1954.

• **Canadian Pacific Airlines,** which in 1953 began its Vancouver-Mexico-Lima service with DC-6B airliners, now has a 12,000-mi. service in operation from Hong Kong via Tokyo to Lima, as well as service from Australia to Vancouver. Late this year it will take delivery of the first de Havilland Comet 2 jet airliners to be used by a North American carrier. Three have been ordered at cost of about $4.5 million for use on the long-stage intercontinental routes, Honolulu to Vancouver, Vancouver-Mexico City-Lima. A fourth Comet 2 is to be delivered in 1955.

During 1953, CPA applied for an all-cargo service from Montreal-Toronto via northern Manitoba to Vancouver, but was turned down.

▶ **Other Services**—The government also had a number of applications for expansion of regional intercity passenger scheduled services by small carriers towards the end of 1953. Decisions are pending, and will have an effect on further expansion of Canadian airline operations. Some of the carriers also asked for permission to operate tourist-rate services. TCA began domestic tourist rate services in February of this year.

An increasing number of U.S. non-scheduled charter air services were licensed by the Canadian Air Transport Board for operation into areas throughout Canada. Many of these operators will carry passengers and freight for mining and exploration companies, as well as tourist traffic.

The Canadian government plans to review with U.S. civil aviation authorities the opening of more international routes between the two countries to two carriers, one from each country. In addition to such new routes, TCA will open a number of new domestic services in 1954.

▶ **Good Year**—Canadian airlines had a good year in 1953.

During the first half, the latest period for which complete figures are available, Canadian airlines flew 433,400,000 revenue passenger-miles and 5,869,000 revenue ton-miles.

Canadian Pacific Airlines in the first 10 months of 1953 carried 197,000 revenue passengers, flew a total of 7,703,200 miles, flew 138,640,260 revenue passenger-miles, and 1,526,589 revenue-ton miles, in addition to 560,044 airmail ton-miles.

Trans-Canada Air Lines in 1953 carried 1,300,000 revenue passengers, a new record, and a total of 30,600,000 revenue miles on domestic and international routes. TCA in 1953 flew 6,200,000 airfreight ton-miles, 1,630,000 air express ton-miles, and 5,300,000 airmail ton-miles. —**James Montagnes**

Gladden
in-line-relief valve
(Also used as Priority, Cheater or Pressure Sequencing Valve)

Actual length 5.50 inches

Now in production

Design features

- Weighs ounces NOT pounds
- Fully qualified and accepted
- Single internal relief pressure adjustment
- Excellent reseating versus cracking characteristics
- Valve function unaffected by high downstream pressures

volume producers of aircraft equipment

Gladden

Offices in principal cities.

Midwest representative:
GEORGE E. HARRIS & CO., INC.
1734 No. Hillside
Wichita, Kansas

Dallas, Texas
Kansas City, Mo.
St. Louis, Mo.
Ft. Worth, Texas
Cedar Rapids, Iowa

Eastern representative:
RECIPUTI & WEISS, INC.
25 John Street
Amityville, L.I., New York

Gladden Products Corp., 635 West Colorado Blvd., Glendale 4, Calif.

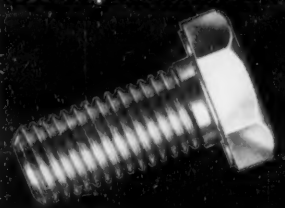
...for
CRITICAL FASTENING PROBLEMS
specify Delron
specialized fastening devices

High Temp, Self-locking, Stainless Steel Nuts—Free Spinning On, Lock... Unlock, Free Spinning Off—Reusable.

DURA-LOC 1200
(temperatures up to 1200°F.)

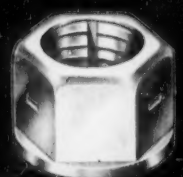
DURA-LOC 1600
(temperatures up to 1600°F.)

High Temp, Stainless Steel Bolts and Screws for temperatures to 1600°F. Special thread form minimizes galling and seizure—Reusable.



DELRON HIGH TEMP BOLT

DELRON HIGH TEMP SCREWS



DELRON #5 Self-locking, Stop Nut—Washer faced: Free Spinning on, lock . . . Free Spinning off after prevailing torque released—Reusable.

FASCO SPACERS Lightweight High Column Strength Aluminum Spacers for assembling and attaching to sandwich-type structural panels.

Illustrated are a few of the many Delron Specialized Fastening Devices designed to help solve your critical fastening problems!

Need data on a specific fastening problem?

Clip this ad to your letterhead, and mail for product data on items checked: AW

☐ Fasteners to 1200°F. operation
☐ Fasteners to 1600°F. operation
☐ Sandwich structure fastening

Name_____

THE DELRON COMPANY, INC.
5224 Southern Avenue, South Gate, California

■ FOREIGN AIRPOWER

Airpower in Japan

Plenty of Talk. Not Much Action

By Alpheus W. Jessup
(McGraw-Hill World News)

Tokyo—Taking inventory of Japan's airpower at the start of 1954, one totals up lots of interest, excitement, plans and dreams in the aircraft industry, but practically no physical airpower.

The single exception is the rapidly developing Japan Air Lines Co., which has completed 27 months of successful domestic operations, and last month began scheduled international operations. This exception uses American equipment in the air and on the ground.

Military airpower lags far behind, and way back of the limited hopes of last year. The aircraft industry has suffered accordingly, although dreams and enthusiasm have brought about reorganization of the major prewar aircraft producers. Until they have a real market, however, little can be expected. And the market can only come from military requirements in this part of the world.

► **Air Planning Group**—Not until last fall was an air planning group created within the National Safety Board (Japan's equivalent of the Department of Defense). This group has just been encouraged by Prime Minister Yoshida's announcement that it will soon become the Third (or Air Force) Staff. Further encouragement comes from a provision in the new budget for the fiscal year beginning April 1 of 8.1 billion yen ($20 million) for this air force, the first direct provisions.

The planning group sets as its first target the training of an instructor group. The USAF has promised the assistance of an 80-man training team which will begin working with the Japanese at Hamamatsu Air Base in April. The initial aircraft to be used will be North American T-6s (on loan from the Far East Air Force), and Beech T-34s (a part of which will be purchased out of budget funds and part to come from loan sources). The planners hope that some T-28Bs may be made available, but they have been advised that the shortage of this aircraft probably makes this impossible.

Later in the year, probably around January 1955, the planning group believes some pilots will be ready for transition into the Lockheed T-33. Again it hopes these can be made available by FEAF.

The alternative to loans from USAF and FEAF could come from the Mu-

Let TWA's wings work wonders with your vacation

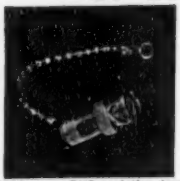
The Champs-Elysées—so beautiful you want to reach out and hold all Paris in your arms. Yet only last night you were winging your way across the Atlantic in a swift TWA Constellation—dreaming of all the promised pleasures and sights of your long-awaited vacation. Tomorrow, new discoveries in France. Next week, Italy. But you've already made the biggest vacation discovery of all . . . the magic of TWA—of wondrous Constellation wings and thrifty Sky Tourist fares that can make your vacation dreams come true anywhere in the world —even in as short a time as 2 weeks!

Visit 16 cities—9 countries in Europe for the fare to one! Stop over in any or all of the cities shown on the map above. Pay only the round-trip fare to Rome!

Where in the world do you want to go? For information and reservations, see your travel agent or call TWA.

Fly the finest... **FLY TWA**
TRANS WORLD AIRLINES

U. G. CONNECTORS



AI-11039, type BNC resistive termination plug. Weatherproof. Styrene Copolymer insert. Neoprene rubber gasket. Can be furnished with any desired impedance.

Our Coaxial Cable Connectors Meet All Government Specifications

•

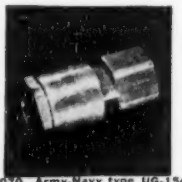
ALL ORDERS DELIVERED PROMPTLY

•

Manufacturers of Highest Quality Connectors

•

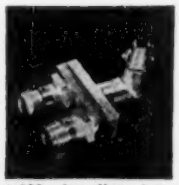
AI-11072, Army-Navy type UG-21D/U, improved type N plug for use with RG-9, 9, 9A, 10/U cables. Weatherproof. Teflon insert, neoprene mating seal gasket, silicon rubber cable clamp gasket.



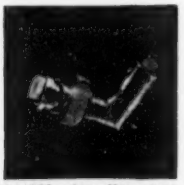
AI-11070, Army-Navy type UG-154/U, type LC plug for use with RG-17, 18/U cables. Weatherproof. Silicon rubber gaskets.

AI-11032, Army-Navy type UG-37A/U, high voltage pulse receptacle pressurized. Ceramic insert, neoprene rubber gaskets.

AI-11022, special type BNC high voltage plug. Mates only with high voltage receptacles and jacks, for use with RG-59/U cable. Weatherproof. Teflon insert. Neoprene rubber gaskets.



AI-11006, Army-Navy type UG-355/U Klystron Coupler. Weatherproof. Styrene Copolymer and linen base bakelite inserts. For use with klystron tube 726C.



AI-11030, Army-Navy type UG-306/U, type BNC right angle adapter. One male, one female end. Weatherproof. Teflon inserts. Neoprene rubber gasket.

ALLIED INDUSTRIES, INC.

1023 S. 21st Street
Louisville 10, Ky.
Phone Arlington 4640

Processing
Designing
Building

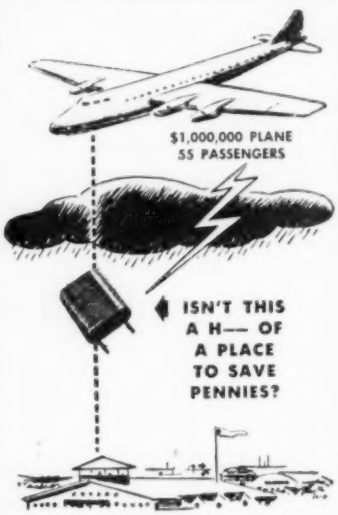
of

AIRFRAME
ASSEMBLY
JIGS & MASTERS

Quotation Basis

MECHANEERS INCORPORATED

Municipal Airport
Bridgeport, Connecticut



THE DIFFERENCE IS SAFETY

You can't buy crystals on price. Dependable crystals cost more because they involve more skill, equipment, experience and integrity.

Since 1942

Pan-El QUANTITY PRODUCERS OF STANDARD AND SPECIAL
Control Crystals
PAN-ELECTRONICS CORPORATION
991 West Peachtree St., N.E. • Atlanta, Ga.

■ FOREIGN AIRPOWER

tual Security Agency. As yet, little is known about what the equipment split will be in MSA aid for Japan. On the air side, no one has indicated whether the aid will be in a form which would encourage Japanese production of aircraft or simply in the form of equipment procured elsewhere and delivered to Japanese forces.

▶ **Industry's Role**—The Japanese industry has had its hopes partially fulfilled with the recent signing of a contract between Lockheed and Kawasaki Aircraft Co. for the manufacture of F-94 Starfire interceptors and T-33 trainers.

Kawasaki also will repair and manufacture jet engines under a deal being worked out by Lockheed and Allison Div. of General Motors.

There is no doubt that the Far East Air Force favors such an arrangement, and that it would welcome a similar one with North American to build the Sabre in Japan. North American has a tentative agreement with Shin Mitsubishi Heavy Industry Co.

The question asked here is how one can expect a sound defense base in Japan or elsewhere in the Far East without some production in the area. None of the Title 3, Asian MDAP countries (Korea, Formosa, Philippines, Indo China and Thailand), can undertake such manufacture for years to come.

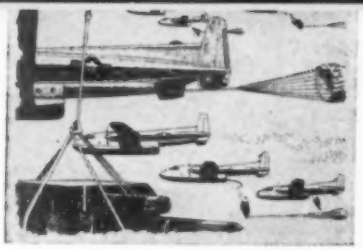
▶ **"No War" Clause**—The Japanese are concerned that they may be led down a rose-covered lane to disaster by present U. S. pressure with regard to Japan's defense forces. In the first place the "no war" clause, which Gen. MacArthur wrote into the constitution which his staff prepared for Japan, stated an ideal situation for an ideal world in which Japan might live. The people by and large welcomed this after the long hardships of wartime austerity and the destruction which U.S. airpower wrought through the major cities of the home islands.

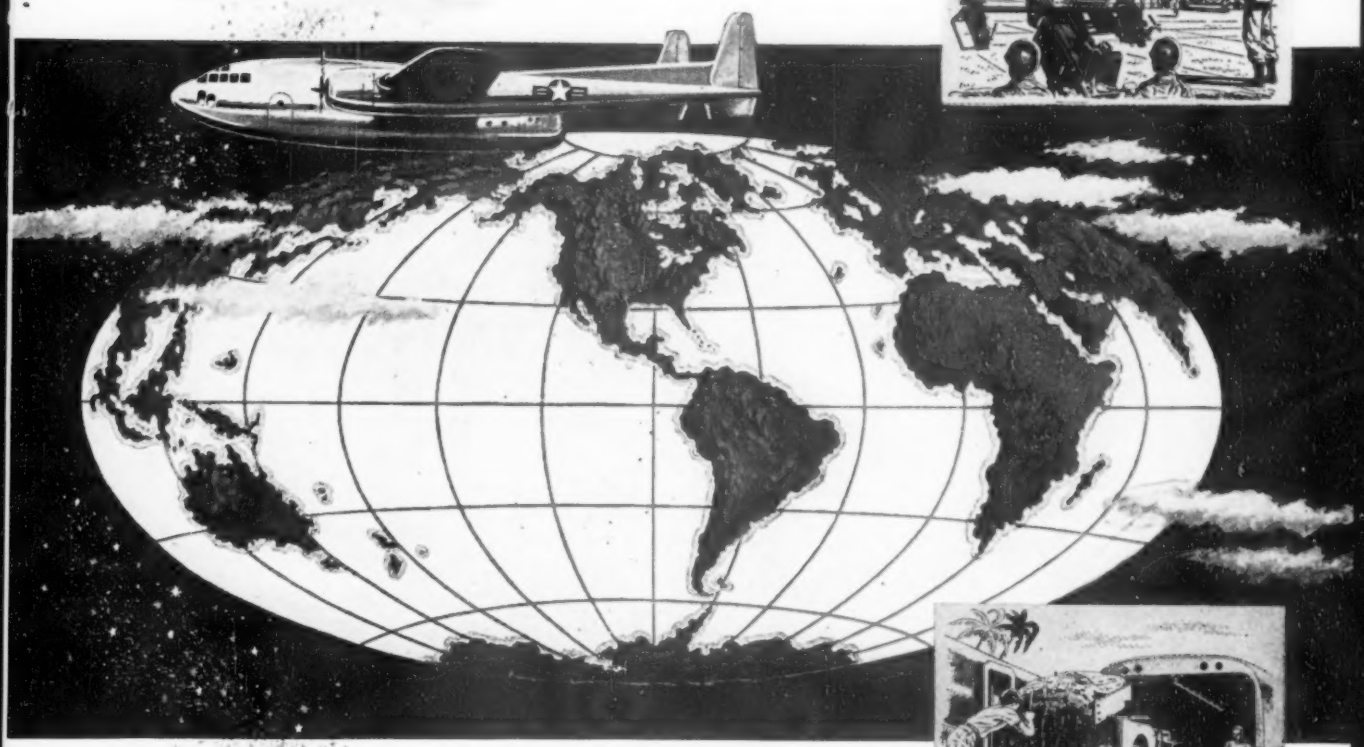
Since 1950, U. S. authorities have sought revocation of the effect of this clause. But policy has been dominantly concerned with ground forces and limited coast-guard-type naval forces. Currently, Ambassador Allison must press for Japanese government acceptance of the U. S. desire for a 348,000-man defense force, primarily foot-soldiers. There isn't a ghost of a chance that the Japanese will accept this goal.

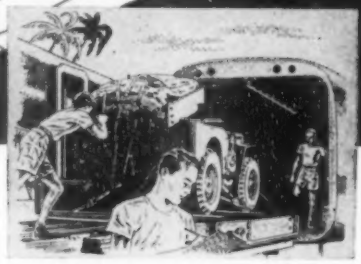
Japanese with some conception of the strategic position of Japan are convinced that a 348,000-man infantry isn't going to defend Japan nor is a 1,348,000-man infantry going to. They note that well over two million men under arms were unable to defend the home island from defeat in World War II.

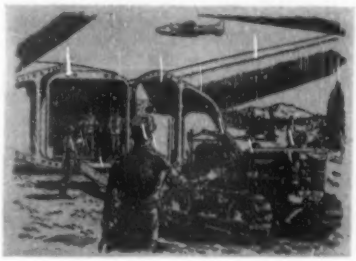
Also, they refer to the reverse situa-

ANY MILITARY LOAD ANYWHERE by FLYING BOXCAR





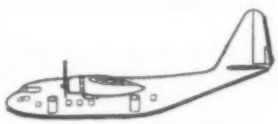




Only airplane designed and built from stem to stern to handle big bulk military loads is the C-119 "Flying Boxcar". Fully equipped troops, guns, ammunition, road-building machinery, helicopters . . . these and countless other types of bulk military loads are shipped to every part of the world at an impressively low cost per ton mile delivered in the Fairchild C-119.

Designed especially to load, fly and unload big bulky cargoes, the "Flying Boxcar" is flying everywhere in the service of America's Armed Forces and those of the United Nations.

ENGINE AND AIRPLANE CORPORATION
FAIRCHILD
Aircraft Division
HAGERSTOWN, MARYLAND



In production soon, the C-123 advance base military carrier.

For the coming American jet age, the M-186 Jet Transport.

Engine Division Farmingdale, N. Y. • Guided Missiles Division Wyandanch, N. Y. • Speed Control Division Wickliffe, Ohio • Stratos Division Bay Shore, N. Y.

A TRULY NEW DEVELOPMENT!

Subminiature Accelerometers

STRAIN WIRE

FULL PERFORMANCE with half the weight, half the size

ONE INCH maximum length means a new stride in compactness for GESCO's new "SUB-SUBMINIATURE" accelerometer — greater versatility, extreme sensitivity, minimum distortion. Smallest yet developed anywhere, to meet equivalent performance specs. 30 day delivery.

SPECIFICATIONS:
Range: ± .5 to 100G Accuracy: 1% full scale
Natural Frequency: 30 to 250 c.p.s.
Temperature limits: −60°F. to +250°F.
Damping: 0.7 of critical
Voltage input: 10 volts AC or DC
Voltage output: 2 to 10 millivolts
Size: ½"x½"x1" Weight: 14 grams

USES:
Acceleration measurements
Flutter analysis
Vibration investigations
Impact research
Guided missile telemetering
Physiological Research
Mechanism investigations

General Scientific produces a complete line of: Linear, Angular and Self-Generating Accelerometers Pressure Transducers • Diaphragms Strain Gages

General Scientific

603 N. La Brea Ave.
Los Angeles 36
WYoming 3104

"Helinews"

Computing with Servo-Driven Potentiometers

by F. R. Bradley and R. D. McCoy

Reprints of this significant paper, which first appeared in the September 1952 issue of TELE-TECH & ELECTRONIC INDUSTRIES, are still available. A copy is yours for the asking.

ASK FOR DATA FILE No. 322

Helipot corporation

a division of BECKMAN INSTRUMENTS, INC.
SOUTH PASADENA, CALIFORNIA
...first in precision potentiometers

234

■ FOREIGN AIRPOWER

tion of Great Britain at the start of World War II. Germany's armies rolled across Europe to the English Channel with little trouble, but were unable to invade England because the Luftwaffe was unable to gain control of the air over the Channel and over Britain.

▶ **Defense Phases**—Top planners in the National Safety Board told AVIATION WEEK that there are two phases to Japan's defense:

- **Defense in the air.**
- **Convoy defense on the sea,** to bring in safely the food Japan needs.

They state that only a defense of the air over the Sea of Japan can protect Japan. They are aware that the major threat—Russian—controls a large, modern jet air force which partly encircles Japan.

Present lag in airpower developments stems from the failure of Gen. MacArthur to include a provision for air forces within the original National Police Reserve which was established in the fall of 1950. He included ground and maritime units only. Gen. Ridgeway, when he succeeded Gen. MacArthur as SCAP, was too concerned with the Korean situation to pay much attention to the Japanese problems.

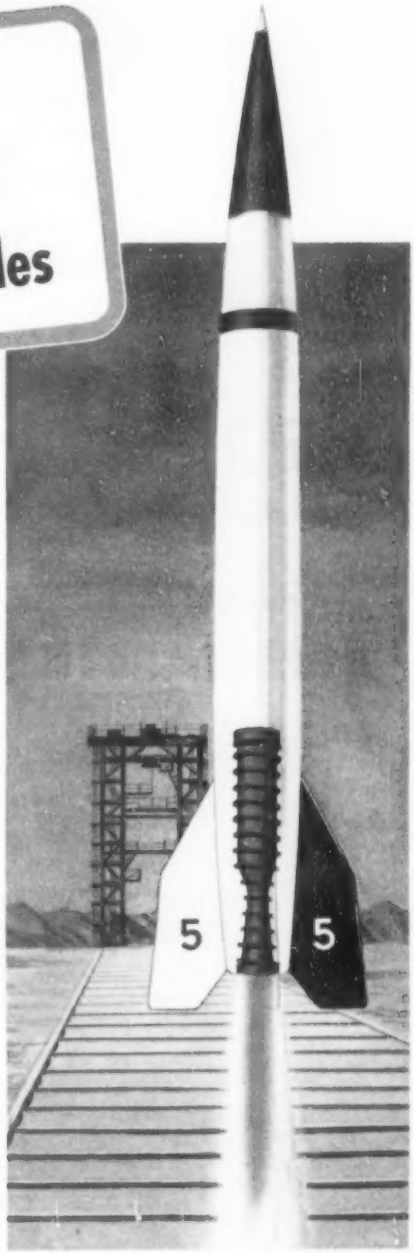
▶ **Gen. Clark's Role**—Things speeded up when Gen. Mark Clark took over as far east commander from Ridgeway. Gen. Clark apparently wanted to win here the battle over Army control of tactical aviation which he had lost in Washington, some observers say. He pressed upon the Japanese safety forces the inclusion of liaison aviation which he hoped would be expanded into Japan's army-controlled air force. Reliable informants in the Far East Command Headquarters told AVIATION WEEK that Clark ignored orders from Washington that he was to take Gen. O. P. Weyland, Far East Air Force commander and senior air officer in the Far East, to all discussions with Japanese authorities on military aviation.

Some army officers have passed the word that Japan's incipient air force is the army aviation now operating in the National Safety Corps. True it has attracted many first-line Japanese pilots, but solely because it provided the only flying available in Japan. It has none of the equipment nor any of the tactical doctrine necessary to defend Japan in the air against a Communist air attack. It is simply an army aviation section capable of providing artillery spotting and taxi service.

Currently, there has been no official change in the U. S. position. Emphasis still is placed upon ground forces. One man asked, "Are we to use our bayonets against IL-28s?"

▶ **Policy Decisions**—Informed U. S. ob-

RYAN builds ROCKET MOTORS for 3000 mile-per-hour missiles



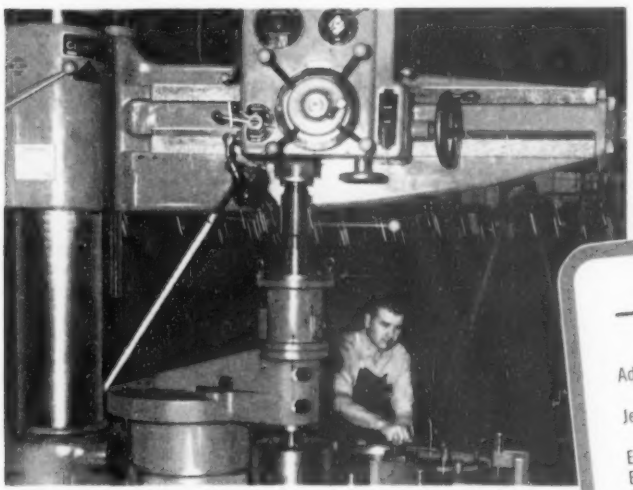
IMAGINE a motor powerful enough to propel a missile at speeds exceeding 3000 mph . . . so powerful that its developed thrust can amount to tens of thousands of pounds. One of Ryan's most challenging current assignments is the complete production of such a motor for an Army Ordnance surface-to-surface missile.

There was a many-sided problem of fabrication, welding and machining that Ryan had to solve in connection with rocket motor manufacture. Because a rocket motor is capable of burning as much as a ton of fuel a minute at temperatures up to 5000 degrees F., terrific internal pressures are created that must be contained in a very compact package of complex construction and exacting dimensions.

The solution was found in perfecting new techniques for forming, welding and machining the special alloy materials. Ryan devised new methods of controlling work to very close tolerances; ingenious electric resistance and arc welding processes and a better furnace brazing system . . . plus intricate machine operations that had to be jewel-like in precision.

Ryan's proved ability in the production of complete rocket motors is due in large measure to its long experience in building the "hot end" of jet and piston engines. Its versatility in many specialized fields is an important advantage in each new assignment, for it enables every division to draw on 31 years of first hand experience in the most advanced phases of aviation engineering and production.

Thus, each year more unique technical engineering and production projects are awarded Ryan . . . an integrated company with superior abilities in meeting the challenges of today's high-speed air age.



RYAN SPECIALIZED INGENIOUS VERSATILE

Advanced-type Aircraft and Components
Jet and Rocket Engines and Components
Exhaust Systems for Aircraft
Electronics Equipment
Ceramics for "Hot Parts"
Weapons Systems Design and Management
Aircraft and Power Plant Research
Metallurgical Engineering
Thin-Wall Ducting
Firebee Pilotless Jet Planes

PIONEERS IN EACH ★ LEADERS IN ALL

RYAN AERONAUTICAL COMPANY

Factory and Home Offices: Lindbergh Field, San Diego 12, California

OTHER OFFICES: WASHINGTON, D.C.; DAYTON, OHIO; SEATTLE, WASH.; NEW YORK CITY

FANTASTIC...but true!

Today's aircraft are substantial investments in the security of our nation. We cannot afford to lose a single one to causes we can control.

Foreign articles entering a single unprotected engine can rapidly reduce a multi-engine jet bomber to a smoldering pile of rubble.

An extremely inexpensive form of insurance is available in Retractable Air-Intake Screens.

Retractable
AIR INTAKE
SCREEN

Specifically designed and manufactured for axial flow compressor gas turbines . . . Hydraulic actuation system contained within the screen housing . . . Strict adherence to AN standards and aircraft quality throughout.

SMITH-MORRIS CORPORATION
PRECISION AIRCRAFT COMPONENTS
FERNDALE 20, MICHIGAN

■ FOREIGN AIRPOWER

servers say that apparently only a National Security Council decision could get the Japan air program underway and that so far there isn't the slightest indication that any decision is about to be made.

The two important policy decisions are:

• **Can Japan shift its emphasis** from ground forces to air forces?

• **Will Japanese industry be encouraged** with MSA assistance and orders in order to create a necessary industrial support base in this part of the world?

The five-year goal of the Japanese National Safety Board planners is a 1,300-plane air force, including 500 to 600 jets, mostly F-86s and F-94s with the necessary complement of T-33s. No bombers are included in their program. Other requirements include some transports and anti-sub patrol craft, as well as light trainers and liaison aircraft. Numbers are unspecified at this time.

The hope is that all types will eventually be built in Japan; but they are not counting on production at this time. The manufacture of modern jet aircraft requires a capital outlay which no company in Japan can undertake. So the bulk of the combat types must depend upon Japanese government or outside assistance.

▶ **Mitsubishi**—The aircraft section of Mitsubishi has been handling overhaul work for the U. S. Air Force for several months, working on the B-26, C-47 and C-46. It is negotiating for F-86 airframe overhaul and will have an assistance agreement covering this work with North American. Further plans for overhaul of the General Electric J47 are underway, according to Iwataro Nakagawa, aircraft section manager.

Recently, Mitsubishi was certificated by the U. S. Civil Aeronautics Administration for the overhaul of Pratt & Whitney R2000 and R1830 engines. Another Mitsubishi enterprise is the assembly of Sikorsky S-55 helicopters for the Maritime Safety Board.

Mitsubishi had an advantage over most other Japanese aircraft manufacturers, in that its aircraft section was not split up by the occupation-sponsored deconcentration procedures.

▶ **Kawasaki**—Kawasaki Aircraft Co. was split into three organizations, and was reconcentrated only at the beginning of last month. The firm, however, has made at least as much progress in recovery as Mitsubishi, and in some ways is further along. It has designed and built its own four-seater lightplane, the KAL-1, and is working on a trainer version which it claims will be similar to the Beech T-34. It also makes a 240-hp. engine for this aircraft.

Under a tieup with Bell Aircraft, Kawasaki will manufacture the 47-D helicopter. The first was completely assembled from imported parts. After the 15th ship comes off the line, Kawasaki expects only engine and rotor will be imported.

The National Safety Corps (the operating or combat command under the National Safety Board) has ordered six helicopters. Orders are pending for the KAL-1 and the trainer.

A temporary agreement has been reached with Lockheed covering aircraft overhaul on the T-33, F-80 and F-94, some of which are now being put through the Kawasaki facilities from FEAF units. Included in the agreement is overhaul of the Allison J33 and J35 engines.

▶ **Nakajima-Fuji**—Another important manufacturer seriously divided by the occupation, was Nakajima. This firm has recently been reorganized as Fuji Heavy Industries Co. It has a technical tieup with Beech for the production of the T-34 Mentor. The first 50 will be imported knocked-down for assembly in Fuji's Utsonomiya plant. From the 51st unit, Fuji plans for complete production in Japan. One of the company's vice-presidents now is negotiating with Continental for the engine manufacturing rights.

Besides the trainer, Fuji expects to receive orders for civilian versions of the Beech airplane, as well as orders from Formosa.

Beyond this the company has no firm plans. The North American and Lockheed tie-ups with Mitsubishi and Kawasaki appear to have sewn up Japan's fighter requirements for sometime to come. The country, with limited resources, probably must concentrate on a few basic aircraft for the necessary defense jobs. So Fuji is considering concentration on guided missiles.

Handicapping Fuji is the long occupation of the newest and best Nakajima factories by the U.S. Army. Repeated requests for the return of the facilities, now called Camp Drew, have been ignored by the U.S. Army.

Prewar Nakajima made over 100 DC-2s and DC-3s. During the war it sent advisers to the Showa Aircraft Co., which continued to make transport aircraft for the Japanese military forces.

▶ **Other Manufacturers**—Showa is doing no manufacturing at present, but it would like to renew its connections with Douglas.

Shin Meiwa Industry Co., successor to the former Kawanishi Aircraft Co., the last of the old Big Five, has been manufacturing auxiliary fuel tanks for FEAF, as have several other manufacturers. It has no other business, but is reported to have had some conversa-

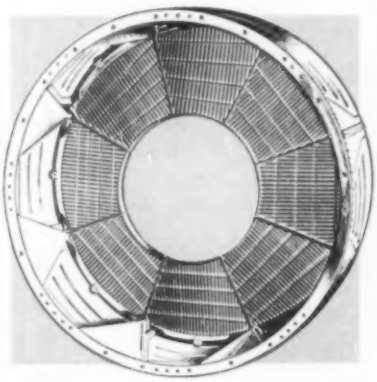
Retractable
AIR INTAKE SCREENS
Could make the difference

The safe interception of exasperatingly small bits of debris entering the engine intake could mean the difference between a safe return and no return.

Retractable Air-Intake Screens are a means of protection that allows the mission to be accomplished without the performance loss and icing hazard of fixed screens.

Retractable
AIR INTAKE
SCREEN

Specifically designed and manufactured for axial flow compressor gas turbines . . . Hydraulic actuation system contained within the screen housing . . . Strict adherence to AN standards and aircraft quality throughout.



SMITH-MORRIS CORPORATION
PRECISION AIRCRAFT COMPONENTS
FERNDALE 20, MICHIGAN

MAKING IT SMALLER LIGHTER . . . AT LESS COST . . . LESS POWER

SPECIFY Micro BEARINGS

"MINIATURE BALL BEARINGS have definitely come into their own and design interest in them will continue to increase with the development of precision control device instruments and similar components."... Product Engineering.

FIRST FOR . . . Microscopic PRECISION

NEW HAMPSHIRE BALL BEARINGS, INC.
PHONE 424 PETERBOROUGH, N. H.

Sub-miniature Radio Interference FILTERS

(actual size)

- Highest efficiency
- Small, lightweight to save space
- For high temperature and altitude operation
- High attenuation

Filters custom designed to meet your requirements!

Phone, write, wire us TODAY!

HOPKINS Engineering Co.

2082 Lincoln Ave., Altadena, Calif. Phone *SYcamore 8-1185* • Offices in Washington, D. C. and Detroit, Mich.

FOILCAL

an AMAZING new discovery lets you

Cut NAME PLATE Costs!

Maintain Quality and Meet All Specifications!

Use rivetless FOILCAL, the new revolutionary etched metal name plate affixed by a permanent pressure-sensitized adhesive. It's easy, simple to apply!

NATIONAL USERS INCLUDE SUCH COMPANIES AS:
Douglas Aircraft Co.
Canadair, Ltd.
Chance-Vought Aircraft

FREE! Test FOILCAL at Our Expense!

• FOILCAL withstands extreme temperatures, resists abrasion and fading. Write Dept. AV-3 today for your FREE packet of FOILCAL samples.

MILLER DIAL AND NAME PLATE CO.
4400 No. Temple City Blvd. • El Monte, Calif.
AGENCIES IN ALL PRINCIPAL CITIES
The Largest, Most Complete Name Plate House in the West, servicing the United States & Canada.

tions with Republic Aviation.

Nippon Jet Engine Co. was founded last year at government insistence and with government capital, to explore jet engine manufacturing possibilities. It was feared that much capital would be wasted if Japan allowed all manufacturers to undertake engine development. Participating in the company are Mitsubishi, Fuji, Kawasaki and the Ishikawajima Heavy Industries Co., which is exclusively interested in engines.

It is known, however, that some of the participants are dissatisfied with this arrangement and would like to undertake direct contact with American or British engine makers.

West Germany

Aviation Marks Time Till EDC Ratification

By Gerald W. Schroder
(McGraw-Hill World News)

Bonn—Until the Western allies ratify the Eastern Defense Community pact or grant Bonn special permission of some type, aviation in Germany will remain more or less at a standstill. This applies equally to civil aviation, aircraft production and the projected German air force.

'Lufthansa'

Officials of the proposed German airline still hope to have their first plane in the air sometime this spring, if . . .

The big "if" in the way of realizing plans for the new "Lufthansa" is the continued delay in ratification of the European defense community. Should the EDC treaty not come into force by spring or summer, Lufthansa officials hope that the three Western powers—the U. S., U. K. and France—can come to an agreement which would let the Germans fly their own airline even thought EDC has not been ratified.

►**Passed Delivery**—The problem of letting the Germans fly their own planes became increasingly acute in the last month, since Lufthansa was scheduled to receive the first of four purchased Convair 340s by the end of February. The German group had to turn the plane down, and Union Carbide and Carbide Corp. picked it up. The Germans feel that the Allies should now grant them the right to fly, without waiting for EDC.

"Plenty of precedents exist," Lufthansa officials say, "You returned the whole field of aviation safety to us, as well as that of airport administration. If we can't import our planes now and

First choice in

FUEL GAGING

for advanced aircraft types

JET FIGHTER

COMMERCIAL TRANSPORT

HELICOPTER

CONVERTIPLANE

The SIMMONDS PACITRON

(Capacitance Type Quantity Measuring)

Recent selection of Simmonds Pacitron fuel gage systems for installation . . . on a fleet of turbo-prop airliners . . . two new Air Force supersonic fighters and a new Navy carrier-based fighter . . . two new model helicopters . . . and a convertiplane again confirms Simmonds' leading position in the design and production of capacitance type fuel gaging systems.

Simmonds fuel gage systems are now flying on seventy types of aircraft – including the fleets of thirty U.S. and foreign flag airlines.

Whether the aircraft installation calls for a "two-unit" fuel gage system or a "three-unit" system, or the inclusion of such fuel management functions as center of gravity control, or fuel level control – Simmonds has a proven record of successfully solving the problem.

WRITE FOR THE LATEST INFORMATION

Simmonds
AEROCESSORIES, INC.
General Offices: TARRYTOWN, N. Y.

BRANCH OFFICES:
GLENDALE, CALIF. • DALLAS, TEXAS • DAYTON, OHIO
SOLE CANADIAN LICENSEE:

This New Structural Material . . .

NOPCO® LOCKFOAM

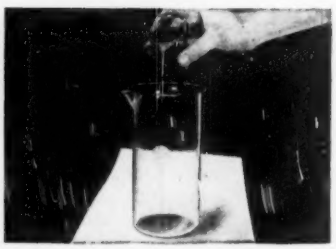
(cellular foamed-in-place plastic)

IS THE EASIEST TO USE OF ALL FOAMED PLASTICS

R COMPONENT

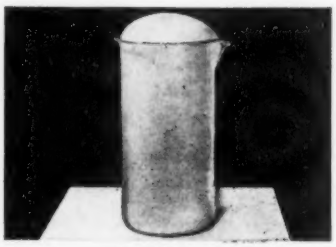
T COMPONENT

1. The T Component (Foaming Agent) is added to the R Component (Resin).



2. The mixed components are poured into a cavity.

The Three Simple Steps in Forming Lockfoam



3. The expanding Nopco Lockfoam completely fills the configuration. Resultant foam is uniform and reproducible.

Nopco Lockfoam's ease of handling, its pour-in-place technique, offers important advantages and economies over other foamed plastics which must be cut and shaped to fit a given cavity. To add strength and rigidity with light weight in filling cavities in ailerons, rudders, elevators, wing tabs, rocket doors, etc., you simply mix two components "on the spot", and pour the resultant foam into the cavity to be filled. The foam completely fills every configuration — then solidifies.

By using Nopco Lockfoam, therefore, labor costs and waste of material are drastically reduced; a further saving is effected by eliminating the need for expensive equipment.

The technical service staff of Nopco's Plastics Division is at your service, to aid you in selecting, formulating, and applying Lockfoam to bring you the greatest benefits from its outstanding advantages.
Write today for the complete story.

USES OF NOPCO LOCKFOAM:

Increase Rigidity *of Ailerons, Rudders, Elevators, Wing Tabs*

Provide a Strong Core *for Nose Radomes*

Fabricate Shock Paneling

Pot Electronic Equipment

Strengthen Shock-absorbing Systems

Insulate Cabin-ventilating Systems

Stiffen Rocket Doors

Dampen Vibrations

and many other uses

NOPCO
EVOLVED THRU RESEARCH

NOPCO
CHEMICAL COMPANY
Harrison, New Jersey
Cedartown, Ga. • Richmond, Calif.

fly them, what are we going to do with them?"

This statement crystallizes the predicament in which the Germans find themselves today. The "AG fuer Luftverkehrsbedarf" is the Cologne-based organization which will eventually grow into the new Lufthansa. This organization purchased the four Convair 340s at a unit price of $650,000 each, plus an estimated 40% of the unit cost for parts and reserve material for each plane. These planes were to be delivered by this spring and to be used on European routes.

The company has also purchased four Lockheed L-1049E Super Constellations at a unit cost of $1.7 million, plus 40% of the unit cost for parts and reserves, and an additional 15% of the unit cost for special installations ordered by Lufthansa.

Payment for these purchases will be in U. S. dollars. No details are given on terms of payment, but it is understood in Germany that Lufthansa received extremely favorable, long-term credits from the manufacturers. Lufthansa officials feel that both Convairs and Lockheeds will serve them adequately for at least a decade.

"We admire British courage in flying Comets, but we still feel that we selected the right type of plane for our operations."

▶**Lufthansa Participants**—The company is now capitalized with DM 25 million (about $6 million). Largest shareholder is the federal government, but a number of prominent West German banks and business firms are also represented.

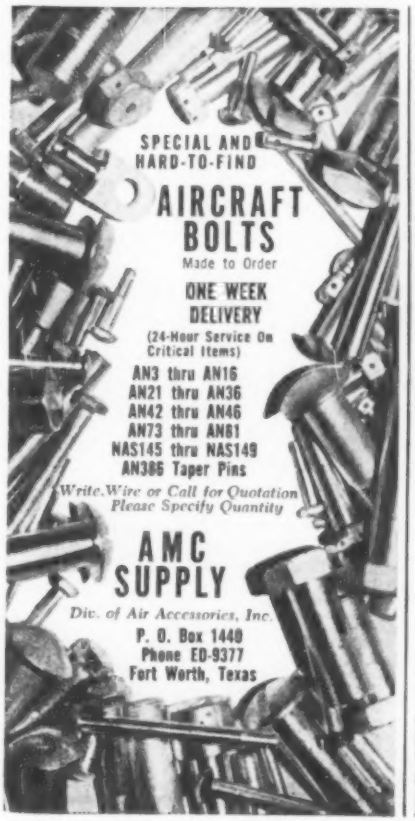
Among these are: Daimler-Benz, Farbenfabriken Bayer, Robert Bosch, Telefunken, Siemens & Halske, AEG, and Brown, Boverie & Cie.

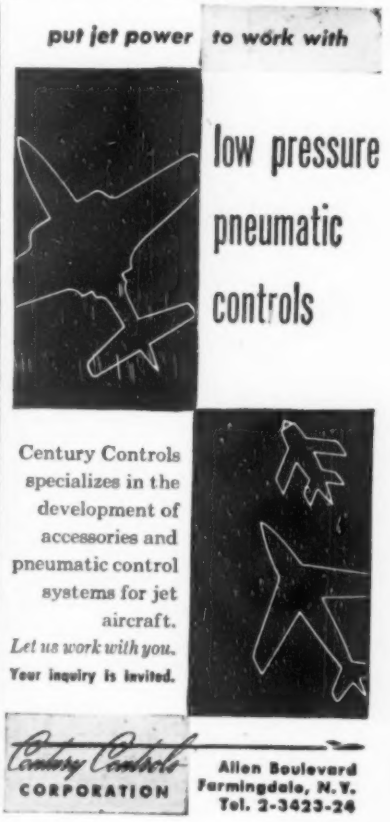
The board of governors of the company is composed of the following individuals: Dr. Max Adenauer, son of the German chancellor; Dr. Kurt Weigelt, Dr. Kurt Knipfer, Prof. Leo Brandt, Prof. Edmund Frohne, Dr. Arnulf Klett, Werner Kreipe, Dr. Heinz Oeftering, Helmut Alt, Dr. Herbert Culmann, von Engel, and Adolf Kummernuss.

It is probable that the company will be recapitalized at around DM 80 million sometime this year.

▶**Fleet Plans**—Final goal of the Lufthansa will be a fleet of around 24 planes, half of which will be used on transoceanic flights, the other half on the European net. It is not certain at this point what type of planes the Germans will buy to complete their fleet. Future types may be of European make, rather than American, but the Germans realize there will not be

i.e.r.c.
heat-dissipating
sub-miniature
TUBE CLAMPING SHIELDS
give lowest bulb temperatures and increased tube reliability!
Patents Applied For
I.E.R.C. tube clamping shields solve electron tube heat and vibration problems. Temperature reduction is made possible by conducting heat directly from bulb to the chassis or heat sink providing greater reliability.
International
WRITE TODAY! For complete information send inquiries to International Electronic Research Corporation, 175 West Magnolia Boulevard, Burbank, Calif.
electronic research corporation




put jet power to work with
low pressure pneumatic controls
Century Controls specializes in the development of accessories and pneumatic control systems for jet aircraft.
Let us work with you.
Your inquiry is invited.
Century Controls CORPORATION
Allen Boulevard
Farmingdale, N.Y.
Tel. 2-3423-24

AIRCRAFT SPECIALISTS IN LONG LENGTH MILLING

SPARS CAPS RIBS

Complete Facilities For all phases of Milling

- Conventional Methods
- Progressive Methods
- Contour Milling
- Continuous Long Length Milling
- Tapered Milling interrupted & continuous

SPAR MILLING DIVISION OF

National Tube Forming Company

Box 534, Union, New Jersey UNionville 2-4371

BETTER . . . FOR SMOOTH CUTTING

ONSRUD Spiral Router Bits for the Aircraft Industry

"Onsrud on Cutters is like Sterling on silver"

Because they SHEAR instead of TEAR the stock, ONSRUD SPIRAL router bits cut smoother, cleaner, faster. Breakage and overheating are minimized. Bits last longer. Costs are reduced, production increased, work improved.

WRITE TO ONSRUD about YOUR special problems. Ask us to recommend and submit the correct router bits for your needs. Or MAIL COUPON FOR CATALOG.

ONSRUD CUTTER MFG. CO.
800 E. Broadway, Libertyville, Ill.

ONSRUD CUTTER MFG. CO.
800 E. Broadway, Libertyville, Ill.

Please send 72-page illustrated catalog and price list of Onsrud Routing Bits and Cutters.

Name _____

Firm _____

Address _____

City _____ State _____

REDUCE Z GAP

PROTECT O RINGS

THE REID WAY

← Teflon BACK-UP RINGS

This Not This

REID pioneer in chemically-inert Teflon, introduces 30° scarfing to reduce Z-gap and prevent marking or distortion of O-Ring. • Newly designed to fit BOTH piston groove diameter and rod diameter. • Many times more accurate than leather. Much lower coefficient of friction. • Non-corrosive, long-wearing, self-lubricating. • Withstands -100° F. to 500° F. • MANDREL-packed to maintain dimensional accuracy, prevent tangling. • 4 types: spiral, spiral even-cut, split, solid. • Write today.

REID Enterprises
Kimball 9243 3715 Santa Fe Avenue Los Angeles 58, Calif.

German-made planes for many years.

Lufthansa officials hope to start their first European flights by July 1. Convair 340s will fly from German cities to London, Paris and Zurich. A final decision on whether to fly to Madrid or Rome is still pending. Lufthansa plans also call for up to six weekly flights to North America by summer 1955, with an estimated yearly passenger total of 28,000.

Lufthansa's headquarters will remain in Cologne, while the fleets's home base will be in Hamburg where the city government recently appropirated DM 20 million for construction of necessary buildings and installations.

► **Training Program**—While waiting for the political green light, Lufthansa is busy training its personnel. Four German pilots, all of them prewar Lufthansa captains, went to England last December to undergo a 10-weeks' training course at Air Training Service at Hamble. The youngest of these pilots is 43, the oldest 47 years of age. At the end of this course, the German pilots will receive British licenses.

Three German instructors are also attending this course as "observers." This group is made up of one technician, one meteorologist and one safety expert. At the same time, 21 Germans are now being trained in Cologne as engineers, radio operators and navigators.

Within the last year, the total Lufthansa staff grew from 40 to a total of 200 individuals, and will probably jump to 350 within the next few months. It is obvious that, once the legalistic obstacles have been removed, the Germans will be airborne within a matter of weeks.

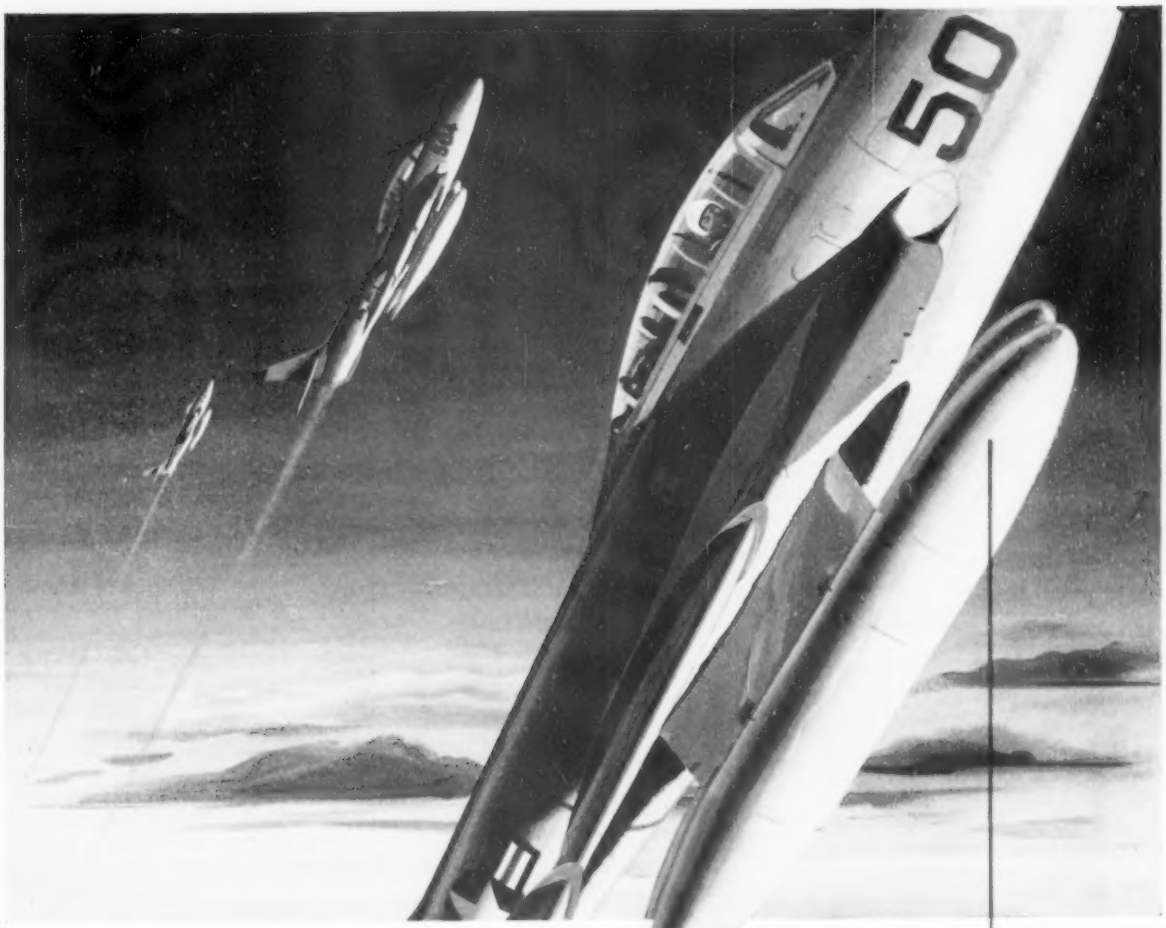
German Air Force

Plans for the establishment of the new German air force are well advanced. Although most of the details are still secret (and the whole project depends on ratification of EDC), the following outline is reliable:

The new German air force will consist of 20 groups: 10 fighter-bomber groups for technical ground support; five fighter groups; and five groups composed of transport, reconnaissance and liaison planes, including helicopters.

► **1,500 Planes**—The German air force, once completely established, will number about 1,500 planes. The Germans will also get a navy air arm, but this will be so small that they speak of it with embarrassment, if at all. It will include 24 long-distance reconnaissance planes and 30 helicopters for anti-submarine and rescue missions.

No decision has been made as yet on the types of planes to be used,



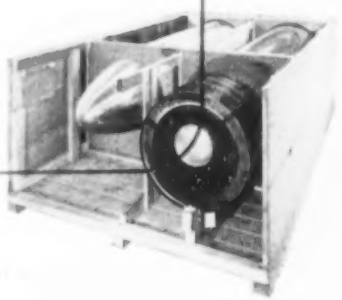
10 in the space of one

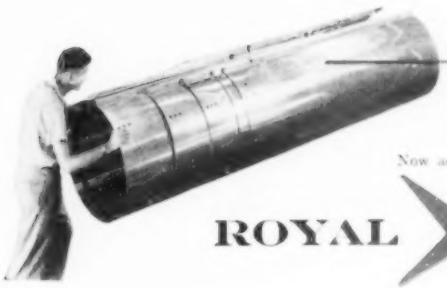
In the space normally used for shipping and storing one wing tank . . . Royal Jet *ships ten, stores ten.*

Royal Jet, Inc. designed,* developed, and now manufactures the only ten-to-one high nesting ratio tanks accepted by the U. S. Air Force. These tanks are currently being used on the latest model jet aircraft. This nesting annually saves millions of dollars in shipping, storage, and handling costs.

On one shipment alone, $325,000 was saved. And, when the 450 gallon tanks arrived, they were easily assembled with simple hand tools. Wherever possible, Royal Jet continues to improve and economize this operation—so vital to national defense.

**in collaboration with Century Engineering, Inc., Burbank, California*





Now accepting applications for qualified engineers

ROYAL JET, INC. ALHAMBRA, CALIFORNIA

(formerly Royal Heaters, Inc.)

All REBAT'S are Built for Maximum Power at Minimum Weight . . . this New Baby offers

up to 6 pounds less weight

than other comparable batteries

the NEW Rebat R3151

Flyte-weight

AIRCRAFT BATTERY

meets all Capacity requirements of AN Specification MIL-B-6147

High Capacity

REBAT'S all new type R3151 Flyte-weight is a 24 volt, weight-saving battery developed for replacement in all Beech D18 models and other AN3151-2 type applications. The Flyte-weight features the revolutionary new "Power-Guard" lightweight case which offers high resistance to impact . . . increases capacity-to-weight ratio . . . eliminates metal case corrosion problems. The Rebat R3151 conforms to standard exterior dimensions, but has more interior space for elements . . . greater liquid capacity. Micro-porus rubber separators are used for longer battery life. For lighter weight . . . higher capacity . . . longer life, install the Rebat Flyte-weight R3151.

MAIL COUPON FOR FREE DATA SHEET.

Rebat

Finest Aircraft Batteries

READING BATTERIES, INC. • Reading, Pa.

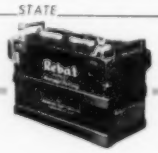
Send me data on new Rebat R3151 ☐

include Rebat Aircraft Battery Catalog ☐

NAME_____

ADDRESS_____

CITY_____ STATE_____



where they will be obtained and whether they will be purchased by the Germans or be given them on a sort of EDC or NATO lend-lease arrangement. The Germans are anxious, of course, to get the very latest models. It is probable that at least the fighter planes will be U. S. models, but consideration is also being given to British and French types.

▶**Age Creeps Up**—The German air force, including mechanics and other ground personnel, will number about 80,000 men.

Training these forces will be a major problem for Germans.

If the European Defense Community does not come into being within a year or two, few of the ex-Luftwaffe pilots will be young and healthy enough to form the backbone of the new air force. If EDC became a reality this spring, however, up to 30% of the pilots needed for the new Luftwaffe could be drawn from the ranks of World War II pilots, German sources say. The names of these pilots have been compiled in Bonn and the men are ready to start training at a moment's notice.

The other 70% of the future pilot force—youngsters who are new to flying—would receive their basic training in Germany and other EDC countries.

The question of airfields suitable for jets will also become a problem for the new Luftwaffe. Some old German army fields, not now in use, may have to be enlarged and modernized. The Germans may also have to share some of the present airfields now assigned to NATO forces.

▶**Three Years to Build**—It would be idle to expect the German air force to bolster Western defense immediately after EDC is ratified. It will take at least 15 months after EDC ratification to get the first combat-ready group into the air; and it will take between 2½ to three years before a new Luftwaffe is completed.

Bonn officials do not feel that the German aviation industry will be ready and able to contribute materially to the build-up of the German air force for at least two years after EDC is ratified. Even then, the German aviation industry will not be able to build military aircraft.

Planning for the new Luftwaffe is now in the hands of ex-Luftwaffe colonels Richard Heuser and Werner Pamitzki. Both men are experienced staff officers with considerable combat experience in World War II.

Aviation Industry

Nothing new can be reported from the German aviation industry. As the

Those long, pipeline attachments on this helicopter are "guns" in the war against the insect foe, spraying death for the moth with scientific precision.

"Operation Squirt" at East Coast Aviation

CHECKING RADIO EQUIPMENT. Two Aero Tech students follow the school's guiding principle, "Learn by doing," as they check radio equipment in nose of plane.

FUTURE PILOT. Aero Tech student smiles after successful "blind flight" in Link Trainer. Many graduates are now airline captains and maintenance supervisors.

If it involves an airplane, East Coast Aviation has probably done it. Located at Bedford (Boston) Airport in Massachusetts, this unusual firm services resident and transient aircraft, operates the famous East Coast Aero Tech training school for pilots and mechanics, and participates in missions ranging from pest control to air-sea rescue. No doubt about it—East Coast planes get a work-out!

That's one reason why, for the past eight years, East Coast Aviation has used Cities Service products exclusively. Says president John T. Griffin: "We have found Cities Service Aviation Gasolenes and Koolmotor Aero Oils capable of meeting the exacting requirements of our customers and our varied operations."

There's a Cities Service product to suit your aviation needs, too. Contact your nearest Cities Service office for information.

CITIES SERVICE

AVIATION PRODUCTS

New York · Chicago · In the South: Arkansas Fuel Oil Corp.

Could It Fly Without Cherry Rivets?

Certainly!

Without any doubt, the fastest piston-powered airliner—American Airlines' new DC-7 Flagship—could have been built (with some modification) without blind rivets. Cruising at 365 miles per hour in the quiet comfort of the luxurious cabin, you, as one of the 60 passengers on the nation's first *nonstop* trans-continental service, would never know the difference.

Yet, Douglas engineers will tell you that the thousands of Cherry Blind Rivets used in the DC-7 make it possible to accomplish fastenings which otherwise would be difficult or impractical. For example, the clean, aerodynamic design which contributes to the high speed of the DC-7 stems from the use of Cherry Rivets in fastening components of control surfaces and other streamlined sections.

The compact anti-icing units, the cabin heaters, the super air conditioning system are designed to eliminate bulk and excess weight. They involve many blind spots which are inaccessible for conventional riveting. Cherry Rivets help make these installations quickly, securely—unit costs are reduced.

Cherry Rivets are installed by one man from one side of the work by a special gun which pulls the stem into the hollow shank—upsets the end on the blind side—firmly clinches the rivet in place—fills the hole—all in a split second. Bucking is eliminated.

Cherry Rivets are but one group of the 10,000 types of fasteners and special cold-formed parts produced by Townsend in its several plants. As "The Fastening Authority," Townsend will help you speed production—produce better products—reduce costs by applying its method of manufacture to your fasteners and small parts. Special bulletins describing Cherry Blind Rivets and other Townsend products and services are yours for the asking.

Townsend

COMPANY • ESTABLISHED 1816

NEW BRIGHTON, PENNSYLVANIA

Sales Offices in Principal Cities

Cherry Rivet Division • Santa Ana, California

In Canada: *Parmenter & Bulloch Manufacturing Company, Ltd., Gananoque, Ontario*

Use coupon below or write

TOWNSEND COMPANY
Sales Department
New Brighton, Pa.

Please send to me without obligation Cherry Blind Rivet Bulletin TL-76.

Name _____ Title _____

Company _____

Street _____

City _____ Zone _____ State _____

years go by without EDC ratification, industry leaders feel that they are slipping farther and farther behind the rest of the world in such matters as research, capable designers and a trained industrial force.

► **Aero Union**—In a spurt of optimism, the "Aero Union" was formed last year by Daimler-Benz, Focke-Wulf, Dornier, Heinkel and Messerschmidt. Aero Union had hoped to build planes in Germany, under license from U. S. firms, for the new Lufthansa. The project, for obvious reasons, fell through and Aero Union has reverted to a state of resigned inactivity.

In the meantime, the industry is turning increasingly to the production of other goods; Heinkel is busy making automobile parts for Auto-Union and Tempo; Dornier is making looms; Focke-Wulf produces gliders, and Messerschimdt sewing machines and three-wheeled "auto-rollers."

Gliding

Each year brings an increase in the popularity of gliding in Germany. Recently, West Germany's Aero Club reported a membership total of 45,000, of whom, about 28,000 are qualified glider pilots. Over 150,000 glider take-offs were made from 200 fields in 1953.

Top glider manufacturers in Germany are Focke-Wulf, Wolf Hirth, Alex Schleicher, F. W. Schmetz, and the Espenlaub Flugzeugbau.

Most prominent promotor of gliding in Germany is Miss Hannah Reitsch, who took a lightplane off a Berlin street under Russian artillery fire during the seige of that city and is one of the few Germans to see Hitler in his Berlin bunker before his death.—**Gerald W. Schroder.**

Italy

Aviation Falls Short Of Earlier Promise

(McGraw-Hill World News)

Rome—Unsettled political and economic conditions both here and abroad have combined to smother earlier hopes that 1953 would be a signal year in the rebirth of Italian aviation.

► **Best-Laid Plans**—The Rome Government had officially proclaimed its intention of placing at the disposal of the aviation forces 1,000 first-line planes; a plan had been prepared by civil aviation authorities that, at a cost of $50 million over a three-year period, would have marked the first step towards placing the airlines services in a position matching the possibilities of the country.

The aeronautic industry had acquired new energy. The few surviving factories were completing the first mass production of the training planes that were to assure the revival of Italian aviation. At the same time, they were rapidly equipping themselves, encouraged by the first NATO offshore procurement contracts, for producing and assembling F-84 parts in the south and F-86 parts in the north.

The design of new training planes, and the preparation of new models for light transports and jet fighters were engaging the time of the best-known Italian engineers, encouraged in their work by the revival of government orders and by the hope of securing a share on the future plans for European rearmament.

▶**Gang Aft Agley**—But this sudden revival of enterprise and of hopes gradually gave way as the year advanced. The changed attitude was brought about by new political and economic conditions both at home and abroad, characterized by the gradual loss, or at least postponement, of what had seemed to be the immediate prospect of the revival of Italian aviation.

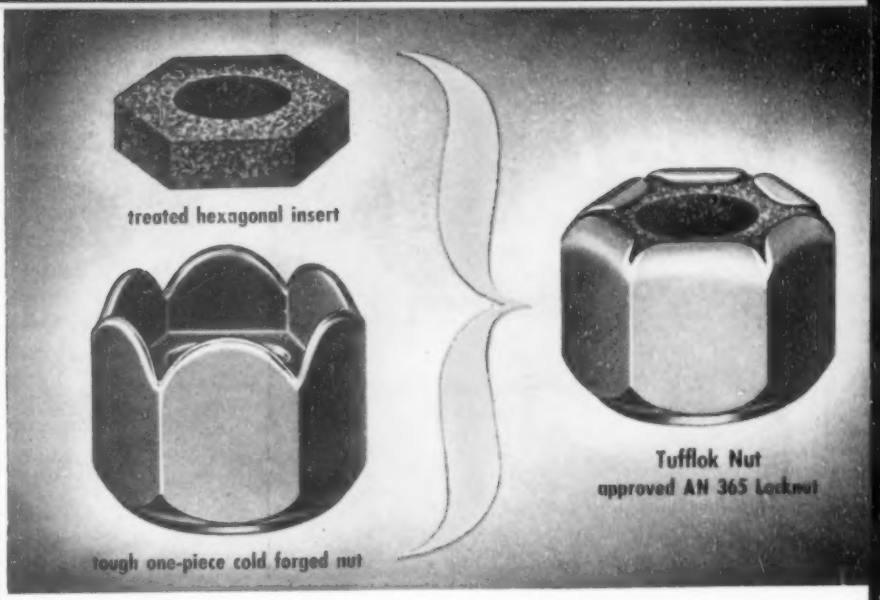
The political elections of June 7, when the de Gasperi government fell, produced a political situation differing widely from the previous one, and this has not failed to exert an influence on aviation plans.

In the first three years of the Italian rearmament program, the scanty means available had been concentrated on land forces, with a view to promoting the formation of the largest possible number of efficient divisions for immediate use and to absorb the large supplies of ground weapons sent by the United States and Canada.

The strengthening of the air forces was to have started July 1, 1953, and part of the special appropriations made for the army was to have been transferred for this purpose. But the new government which took office after July 7 did not confirm the special appropriations. So Italian aviation for the fiscal year 1953-54 had at its disposal only some $140 million dollars—less than the funds allotted the previous year and $70 million below the minimum on which the Italian aeronautics officials had counted for starting the execution of their plans.

▶**Partial Fulfillment**—It is not, therefore, surprising that under these conditions it has only been possible to carry out partially the limited plans for 1953.

Of the 27 groups of first-line aircraft which were to have been formed in 1953, only 19 have been completed, 12 of them supplied with jet planes—F-84 Thunderjets and Vampires (a hundred of the latter were built in Italy).



You Get Tight Grip—Safety and Economy with Townsend Tufflok® Nuts

The tight grip and great safety you get with the Townsend Tufflok* Nut come from its special design and materials which combine to make it the toughest locknut ever produced.

Cold Forged Body of Tufflok Nut is in one piece. It has high mechanical strength and an exclusive petal design assures positive staking of the insert.

Tough threads are cut in cold-forged steel—are stronger—spin on easier—resist galling—speed up application—afford more reuse.

Treated Hex Insert is resilient, vulcanized, fibre having high mechanical strength. It resists moisture, drying out, high-octane gasoline and lubricants.

Positive Locking Action is provided by hex insert in which threads are impressed in fibre—setting up constant pressure against the bolt threads, providing a friction grip, and holding the nut tight against vibration.

Tufflok Nuts are economical—have been proved by use and by test. They are approved against Air Force-Navy Aeronautical specification AN-N-5 and are listed in Air Force-Navy Aeronautical bulletin ANA 159g as an approved AN 365 Part under Nylok part numbers.

To learn more about the tight grip and positive resistance to vibration and shock obtained with Townsend Tufflok Nuts, write for free literature.

*Licensed under the Nylok Corporation patents.
Tufflok is a registered trademark of Townsend Company.

Townsend
COMPANY • ESTABLISHED 1816
NEW BRIGHTON, PENNSYLVANIA
Sales Offices in Principal Cities
Davey Bros. Division, North Hollywood, California

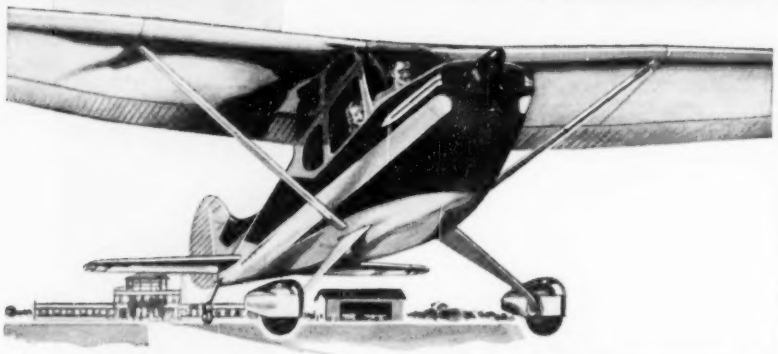
In Canada: *Parmenter & Bulloch Manufacturing Company, Ltd., Gananoque, Ontario.*

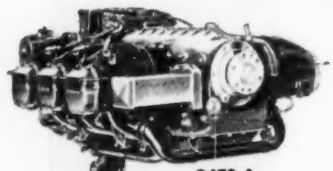
TOWNSEND COMPANY
Sales Department
New Brighton, Pa.

Please send to me without obligation Locknut Bulletin TL-63.

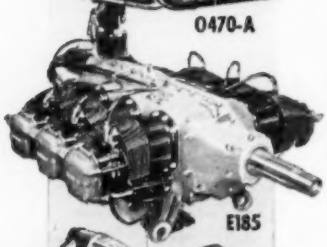
Name _____ Title _____
Company _____
Street _____
City _____ Zone _____ State _____

FIRST from ANY ANGLE

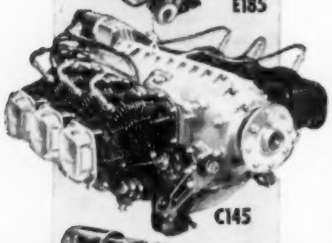




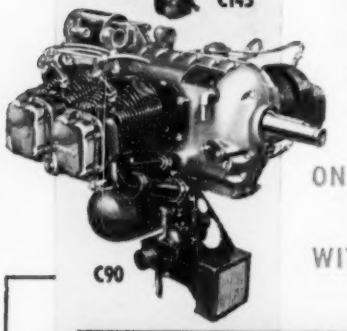
O470-A



E185



C145



C90

Powerful as the Nation — CONTINENTAL MOTORS — AMERICA'S STANDBY

...CONTINENTAL AIRCRAFT POWER

Any way you look at it, Continental is the undisputed leader when it comes to powering planes of utility types . . . and its leadership, in all the things which go to make up that quality, was never before so complete—so dominant—as it is today. More and more of the world's finest business and executive aircraft are flying with dependable Continental Red Seal power.

ONLY CONTINENTAL BACKS YOU WITH ESTABLISHED WORLD-WIDE SERVICE

Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN

■ FOREIGN AIRPOWER

In the case of the infrastructure program only 60% has been carried out, though the part referring to the military airfield program, financed by NATO, will be executed in full.

▶ **Industry Suffers**—Under these circumstances of reduced financial means, the sudden advent of a considerable number of modern American jet planes has created further difficulties for the Italian industry.

The upkeep of a squadron of modern American jet planes costs a good deal of money, and so the funds that had been intended to finance the preparation of new designs and construction in Italy have to a large extent been absorbed for the utilization of the aircraft received from abroad.

Italian authorities are now pursuing, within their scanty means, the objective of equipping the Italian industry so that in addition to producing and assembling the standardized NATO models, it may also produce planes that have been studied with a view to meeting specific Italian needs (training, air defense).

▶ **Experimental Production**—With this in view, priority has been given to the construction for experimental purposes of a small number of the following planes:

• **Sagittarius**, an interceptor-type airplane with sweptback wings and high climbing power. It was designed by Stefanutti, and a first flying model, made of wood, was built by Ambrosini. A limited number is now being made at the Acrfer works in Naples. Italian experts claim this airplane could be the means of defense in the poorer countries of Western Europe. They say its cost is only 15% of that of others of like character, British and American, though these latter have longer range and duration.

• **G.82**, designed by Gabrielli. Fiat has started building a small series of this plane, used for training fighter pilots. It is fitted with a Rolls-Royce Nene jet engine, and can attain a speed of Mach 0.9.

In addition to these experimental planes, a number of de Haviland Vampires was built in 1953 to be used for training fighter pilots, and the deliveries of the Piaggio 148, the Macchi 416, and the Ambrosini Super 7, ordered in 1951 and 1952, were completed. They will be used for advanced training.

At the aviation experimental station at Guidonia (Rome) three planes built to a basic trainer specification are now being tested. They are the Fiat G.49, the Macchi M.B. 323 and the Piaggio 150. The future of these planes will depend on the hoped-for increase in appropriations for Italian aeronautics.

Among the more recent projects (which so far has not got beyond the stage of designs) there is a three-engined jet design for medium-distance transports. Plans for this aircraft have been made independently by Zapata of the Agusta Co., Marchetti of SAI Marchetti, and Casiraghi of Piaggio.

▶**Spread Thin**—The $42 million so far granted for offshore procurement contracts have enabled Aerfer of Naples to start active work producing under license F-84 fuselage parts. Fiat is doing the same kind of work on the engines and fuselage of the F-86.

But even when we add to these contracts the orders placed by the Italian Ministry for Air Defense, the whole of the work has so far been too widespread and too diversified to permit a revival and general reorganization of production. Present output is still far below the potential of the ten thousand workers now in the employ of the Italian industries engaged in building planes and aeronautic material.

▶**U.S. Aid Needed**—To assure the steady recovery of aeronautic production, qualified Italian authorities consider that a much greater effort would be required than any so far made; and they hope that further appropriations will be made for this purpose in the near future when the new government revises the defense estimates.

But however willing the government may be to do what is necessary, these same circles are of the opinion that Italian resources will never be sufficient and that further American aid will be more than ever necessary, not only in the form of offshore procurements, but in financial assistance for the purpose of supplementing Italian defense budget estimates.

At the last meeting of NATO, Italy undertook to make a further extraordinary appropriation of 250 billion lire ($400 million) spread over two years for defense expenditure. Within the framework of the NATO programs the Italian authorities also propose:

• **To obtain from the U.S.** an agreement that the F-86K (50 of which Fiat is assembling) be built entirely in Italy, as an offshore item. A group of factories in North Italy—Fiat, Piaggio and SAI Marchetti—would be engaged, according to the size of the order, in building those planes.

• **The same authorities believe** that in view of the relations now existing between Fiat and General Electric, it should not be difficult to reach an agreement between the two groups under which the Sabre's engines also would be built in Italy.

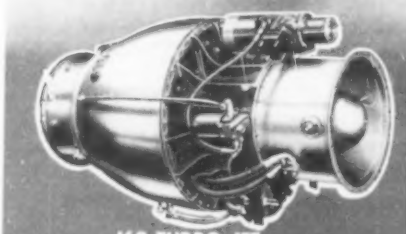
Fiat might also make the G.82 trainers, should the trials with the first model give good results.

The concerns controlled by IRI (the

Jet power FOR THE AIR AGE

These Continental gas turbines, now in production at C.A.E., are finding acceptance in a steadily-widening range of applications where shaft turbines, air generators or turbo-jets are required. Manufacturers with present or prospective need for units of exceptional dependability are invited to bring their problems to C.A.E.

MODEL 140 AIR GENERATOR
Supplies up to 2000 cu. ft. per min., at 50 p.s.i. In production, for use as starter for large turbines; numerous other uses in prospect.



J69 TURBO-JET
Jet power for target and trainer aircraft, and auxiliary power for transports and bombers. Develops up to 1,000 lbs. thrust; still higher output in prospect.

ENGINEERS AND OTHERS DESIRING CAREERS IN THE FIELD OF SMALL TURBINES: WRITE TO C.A.E., STATING BACKGROUND AND TYPE OF WORK DESIRED.

CONTINENTAL AVIATION & ENGINEERING CORPORATION
1500 ALGONQUIN AVE., DETROIT 15, MICHIGAN
SUBSIDIARY OF CONTINENTAL MOTORS CORPORATION

■ FOREIGN AIRPOWER

Italian government) almost all are located in the neighborhood of Naples, would build the Sagittarius. The turbojet engine for Sagittarius has not yet been selected. Alfa-Romeo of Naples could build them while the radars could be ordered from Microlambda, and the armament from Sangiorgio and Breda.

These plans might of course be considerably modified should EDC be set up, as the formation of such an organization might make it possible to follow more rational lines in the distribution of the work among the members of the European Defense Community.

► **Civil Aviation**—While the conditions of civil aviation in Italy are far from satisfactory, nevertheless the situation seems less unfavorable than is the case with the aircraft factories.

In appraising the situation, a distinction should be drawn between the government's tasks, which have not been carried out because of insufficient appropriations, and those assigned to the companies, to whom the regular line services have been leased. These latter have been carried out to a degree that appears to assure favorable prospects of further development in 1954.

The general direction of civil aviation and air traffic had been charted more than a year ago in a plan approved by the Ministry of Defense which was sent to the Treasury with an application for an assignment of 6 billion lire for the first year and of 12 billion in each of the two following years (rate of exchange: 625 lire = $1). The plan was blocked by the treasury until the department that made the request could show the means by which the funds could be procured, as required by Art. 81 of the Constitution. This means that nothing will be done until the problem wins favor on the political plane.

Thus the plans which provided for the use of a twin-engine transport to be built in Italy by Piaggio, Agusta or Marchetti were blocked. Lack of funds prevented also realization of a plan for purchase abroad of 27 new four-engine and two-engine planes, and entailed the postponement of the construction of new airfields suited to the needs of present-day civilian traffic at Venice, Palermo, and Genoa.

Work on the new intercontinental airport at Fiumicino was slowed down until the start of 1954, because instead of the 24 billion lire estimated as necessary for the job, only 4 billion was appropriated.

► **Closed in the Black**—The only two Italian airline companies now operating—LAI, financed by Italo-American capital, and Alitalia, financed by Anglo-Italian capital—may look back with satisfaction at 1953 and at the prospects for the immediate future. Both companies closed 1953 with a profit, having flown over 50 million kilometers without recourse to any of the subsidies that in prewar days were granted to Italian air carriers.

With the assistance of credit, the airlines have been able to modernize and complete their airfleets with up-to-date American aircraft. At present, the Italian transport fleet includes 10 four-engine planes (DC-6 and DC-6B), already used for the transcontinental services or now expected to arrive; seven twin-engine pressurized highspeed Convair 240s and 340s; and 20 DC-3s, none of which has yet flown more than 8,000 hours.

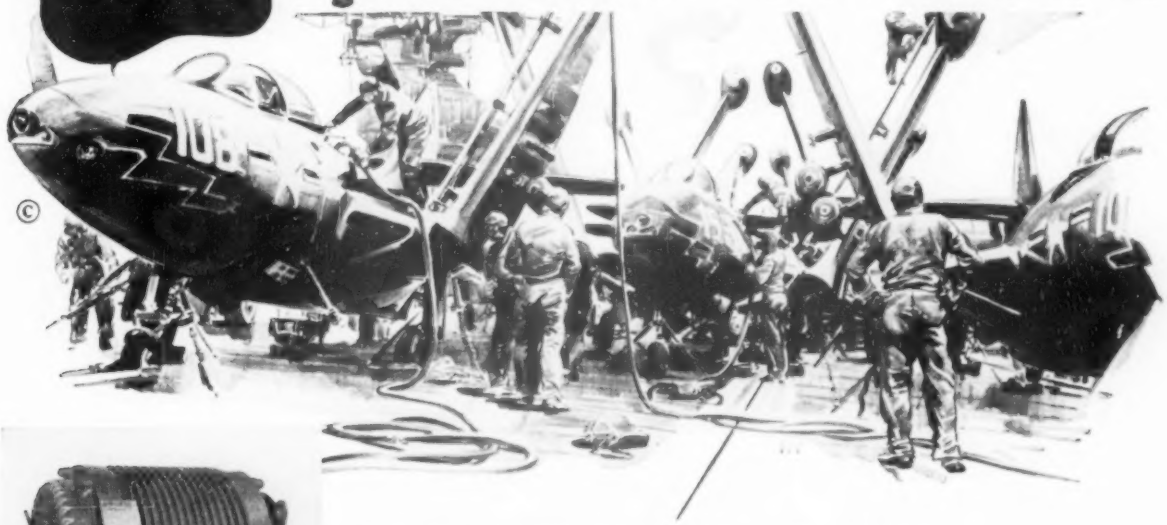
► **More Flights**—The new aircraft now available will allow expansion of the Italian lines and more frequent flights on the more important routes.

It is expected that in the course of the year, flights to New York will be increased from two a week to a daily service; those for South America will have a three-day-a-week service, with stops at various places between Venezuela and Argentina. A line to Tokyo is contemplated, and the services with South Africa and Asia Minor will be extended. New stops will be added in Germany and Scandinavia—**Diego Straniero.**

Heat-resistant asbestos covered support clamps. Type 321 stainless steel.
Clamps
ON HAND
to serve you
Available for immediate or prompt delivery, CLAMPS—including those shown here, or a special design to fit your own needs—are a featured product of Universal.
Years of design and production of airframe components have established UNIVERSAL as a major source in tool making, stamping, welding, sub- and finished assemblies. Designers and developers of the famous Universal Aircraft Fuel Filler Caps.
Nationwide service. When you want clamps — any size, any specification, any quantity — call Universal.
"A WORLD OF KNOWHOW"
UNIVERSAL METAL PRODUCTS, INC.
Tools • Dies • Metal Stampings • Aircraft Parts
Serving America's Aircraft Industry
2311 West Orange Street
CUmberland 3-3115
Alhambra, California

DOW CORNING
SILICONES

give motors more muscles



RELIANCE 20 hp (class H) Motor
330 Pounds Lighter than Conventional Design

For maximum safety, carrier planes are fueled and defueled immediately before take-off or after landing. Several fast reversible pumps are used, any of which can fill or empty a plane's tanks within minutes. The pumps and their motors are big and heavy, however. So much so that the Navy challenged manufacturers to produce new motors which would combine top dependability and absolute minimum weight.

The Reliance Electric & Engineering Company attacked the problem both inside and out. They made the entire TENV frame and the mounting brackets of aluminum, ribbed for maximum heat dissipation. On the inside, silicone (Class H) insulation raises the power-per-pound ratio by over 50%, and also provides extra resistance to weathering and salt spray. As a result, the finished motors are among the smallest and lightest ever made in their class. The 20 hp unit, for example, weighs some 330 pounds less than the conventional 20 hp motor. Already they have been specified for the new super carriers Forrestal and Saratoga.

That's typical of the "design-ability" of Class H insulation made with Dow Corning silicones. Adaptable to any electrical equipment and costing only slightly more than the next best class of insulation, it can be used to increase the power-per-pound ratio or to extend the life of electrical machinery over ten times. For better performance, lower maintenance costs, and greater sales appeal, alert design and management men specify Class H insulation made with Dow Corning silicones

first in silicones

DOW CORNING
CORPORATION

MIDLAND, MICHIGAN

mail this coupon today!

Dow Corning Corporation, Dept. D-15, Midland, Michigan
Please send me

- ☐ List of Class H rewind shops
- ☐ More performance data on Class H
- ☐ List of Class H Motor and
- ☐ Class H Transformer Manufacturers
- ☐ "Tall Tales and Fabulous Facts" about silicone products

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Branch Offices in ATLANTA • CHICAGO • CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEW YORK • WASHINGTON, D. C.
Canada: Dow Corning Silicones Ltd., Toronto • Great Britain: Midland Silicones Ltd., London • France: Cie. St. Gobain, Paris

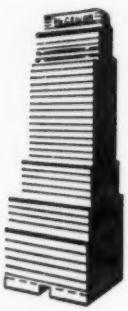
If Your Government Contract....

...or Your Regular Product Requires MANUALS

Call in the McGraw-Hill Technical Writing Service

- OPERATION
- SERVICE
- OVERHAUL
- PARTS CATALOG
- TRAINING

Whether you need one or a set of manuals written and illustrated precisely to meet Government specifications or whether your products are such that instructions on their proper installation, operation, and service must be provided — Technical Writing Service can do the job for you . . .
efficiently . . .
effectively . . .
economically.
Technical knowledge and writing skill are the keynotes of our service.



Write or Phone

TECHNICAL WRITING SERVICE
McGraw-Hill Book Company, Inc.
330 West 42nd Street
New York 36, New York

Tel: LOngacre 4-3000

■ **FOREIGN AIRPOWER**

Spanish Airpower

U. S. Aid Starts Wheels Turning

(McGraw-Hill World News)

Madrid—The mutual aid pact between the U. S. and Spain has taken the lethargy out of Spanish aviation.

Four fields have been chosen as joint U. S.-Spanish air bases: Torrejon near Madrid, Sanjurjo in Saragossa, El Copero in Sevilla, and Moron de la Frontera thirty miles out of Seville. Plans have been drawn to increase the lengths of existing runways on these fields and to strengthen them to accommodate aircraft such as the B-47. Two of the fields, El Copero and Moron de la Frontera, have no runways at present.

Direction-finders, ground-control-approach systems, and other navigational and ground equipment will be installed in anticipation of heavy traffic.

Actual construction awaits the arrival of the personnel from the American combine of Raymond Concrete Pile Co., Brown and Root, Inc. and Walsh Construction Co., who are expected from day to day.

▶ **Training Equipment**—Training equipment and personnel have already arrived. Six jet mobile units have been set up at Talavera la Real in Badajoz to familiarize pilots and train mechanics.

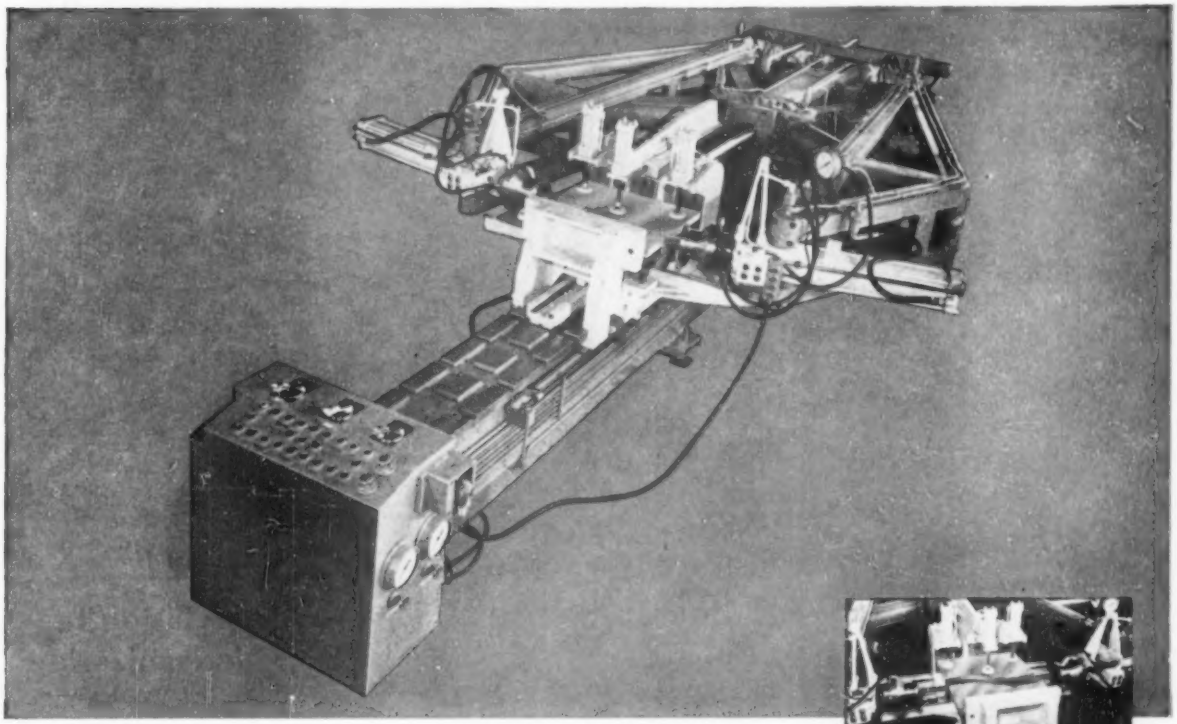
The units contain mockup T-33 engines, bombing-gear and radio equipment. Pilots will receive a short familiarization course here and then go on to North American T-6s and finally into the T-33 jet trainers.

The field at Badajoz has a newly constructed 7,900-ft. runway specifically designed for jet traffic. The first T-33 jets are expected before spring.

The number and types of American jets to be delivered to the Spanish air force is still undetermined. "There is a natural ceiling on the numbers of jet fighters and bombers Spain can maintain," one American spokesman said. "This ceiling is dependent on the ability of the Spanish economy to support them. Spain will receive the amount of aircraft it can support." Spanish Air Force chiefs are studying the problem.

▶ **Three Pilots Per Ship**—The Spanish Air Force intends to throw away everything they have and start over. Currently their fleet is composed of Spanish versions of German Messerschmitt 109 and Heinkel 111. The Construcciones Aeronauticas and Hispano Aviacion factories still have unfilled orders for two hundred more Spanish-version

Still doing it the Hard Way?



HERE'S AN EASIER, FASTER WAY...

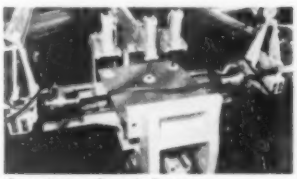
Stretch Wrap Form . . . Set Joggles, Reverse Bends and Severe Degree Changes — *In One Operation.*

There's no need for supplementary equipment, for the SHERIDAN Model E is a *combination* extrusion stretch wrap forming machine *and* bulldozer designed to eliminate many costly operations.

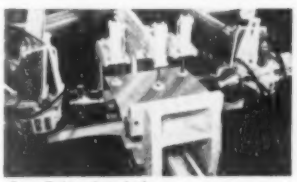
FEATURES THAT STEP UP PRODUCTION, LOWER COSTS

1. **Adjustable Die Table**—eliminates need for special die supports.
2. **Die Hold-Down Cylinders**—control clamping pressure on split dies when forming parts with long legs, parts requiring filiers, etc. Hold-down cylinders are used to separate split dies to speed removal of finished parts.
3. **Independent Tension Cylinder Movement**—facilitates forming of irregular contours without special die layout or development.
4. **Automatic Controls**—eliminates the need for highly skilled labor once job is set up.
5. **Easy to Operate**—complete accessibility, convenient work height makes the Model E the easiest-to-operate machine of its kind.
6. **Trouble-free Operation**—no high pressure flexible hose or other delicate parts to fail or slow production schedules.

Part Before Stretch Forming



Part during Stretch Forming



Part Being Joggled

"If It's STRETCH WRAP FORMING—Be Sure It's SHERIDAN"

SHERIDAN

T. W. & C. B. SHERIDAN COMPANY

Established 1835

135 Lafayette St., New York 13, N.Y.
183 Essex St., Boston 11, Mass.
600 W. Jackson Blvd., Chicago 6, Ill.
405 Via Chico, Palos Verdes Estates, Calif.

European Offices
52-54 High Holborn, London W.C. 1, England

WORLD'S MOST COMPLETE LINE

See SHERIDAN for the world's most complete line of extrusion and sheet stretch wrap forming machines in capacities up to 2,000 tons. For information and illustrated catalog of our complete line . . . write to any of the SHERIDAN offices listed below.

Messerschmitts and Heinkels. After these orders are filled, there will be no more. The total production of military craft has been less than 50 per year, and not all of these have engines. Many of the new engines produced are used to replace old ones in existing craft.

For every ship there are three pilots. The force was increased by 160 pilots last year, bringing the total to approximately 2,000.

▶ **Transport Growth**—While Spain's military aviation is still looking ahead, its commercial aviation has been going ahead. Aviacion y Comercio, the private line started in 1949, has been expanding constantly. Last year they put into service two French Languedocs and two Bristol 170s. More planes are on order.

During the past year the government-supported airline Iberia, which claims the world's lowest accident rate, added three Bristol 170s and two Languedocs to its fleet of six Douglas DC-4s, 14 DC-3s, two Junker 52s and three de Haviland Dragons. This spring they will receive three Lockheed Super Constellations. The Constellations will be used to expand trans-Atlantic operations, possibly extending them to New York.

Iberia now runs to Caracas, Buenos Aires, London, Paris, Frankfurt, Rome, Lisbon (three a day), Geneva. Tangier, Bata, Puerto Rico, Natal and Montevideo. The Bata and Frankfurt runs were added last year. The company has applied for service to Colombia and Miami. Aviacion y Comercio inaugurated three new routes in the past year—Bilbao to Bordeaux, Alicante to Oran and Madrid to Paris.

Last year Iberia operated with 40 crews. At the beginning of this year they had a total of 54 complete crews. The 15 crews at Aviacion y Comercio also represents an increase over last year.

▶ **Industry**—The aircraft industry has been very active in development if not in production of commercial planes. Construcciones Aeronauticas (Casa) has designed and produced the Alcotan which can hold about 20 passengers and the Halcon which holds about 30.

These ships are totally Spanish, including original design and research. The prototypes are being tested while factories are retooling for production. The Alcotan and Halcon will be used for domestic airlines. —**Jocelyn Bush**

Airpower Down Under

Aussie Aviation to Push Modernization

(*McGraw-Hill World News*)

Melbourne—There is no doubt that Australians are anxious to preserve their reputation as the world's most air-minded people and ambitious efforts are being made to proceed with modernization of Australian aviation, both civil and military.

It is generally realized that the efforts will be difficult.

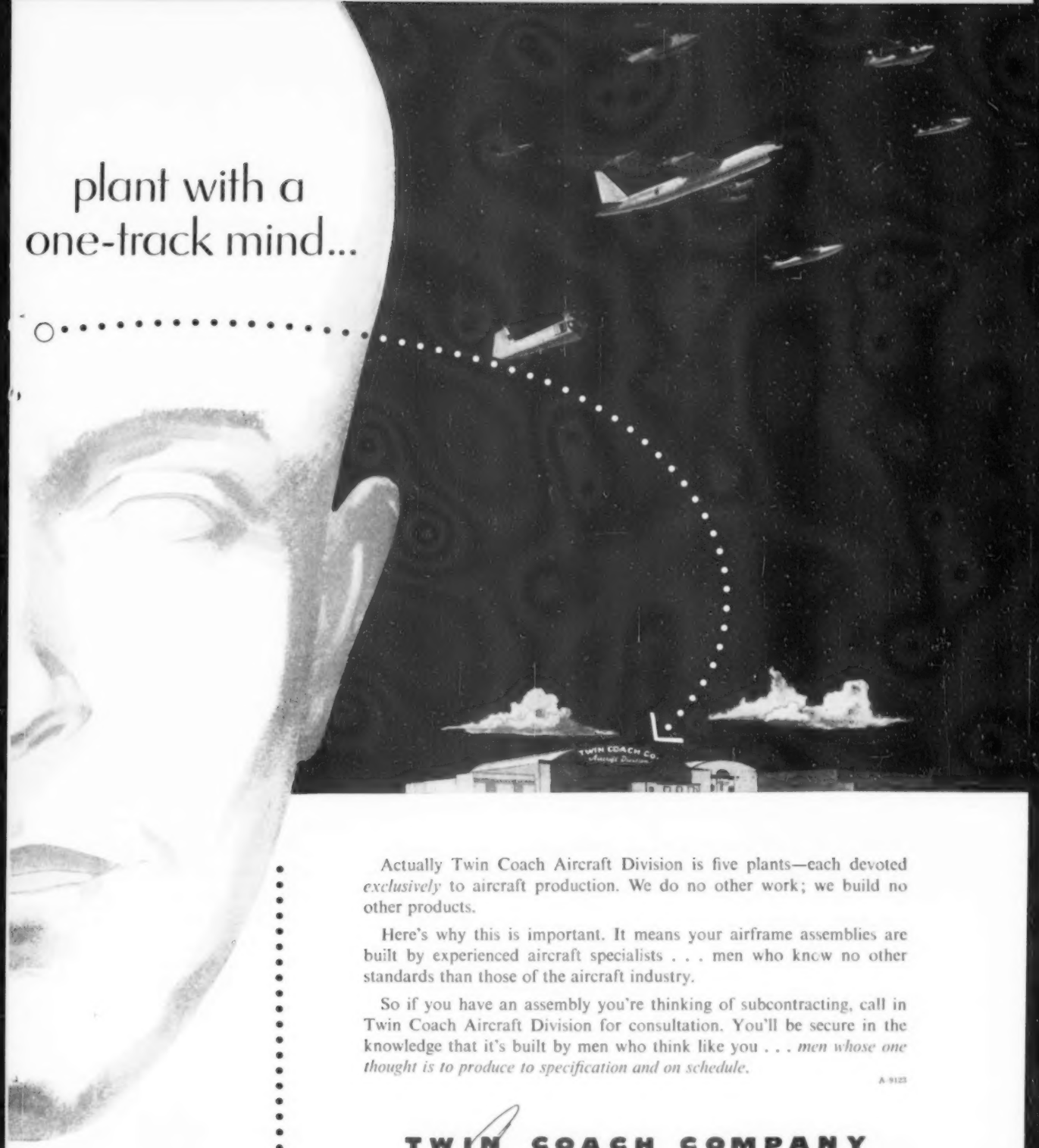
RAAF

The Royal Australian Air Force has less than a dozen modern planes to serve its first-class flying and ground personnel. They are still forced to use a large number of long-forgotten aircraft such as Wirraways, Beaufighters and Dakotas, plus obsolescent Lincolns, Mustangs and Vampires. The Australian authorities and experts realize also that when orders for Canberras and Sabres are finally completed, these planes will be also obsolescent.

Planning is therefore aiming at the creation of a rather small but highly maneuverable force equipped with most modern gadgets in the field of rockets and various missiles.

▶ **Too Good to Waste**—In many responsible Australian circles it is being argued that in a future conflict, the

plant with a one-track mind...



Actually Twin Coach Aircraft Division is five plants—each devoted *exclusively* to aircraft production. We do no other work; we build no other products.

Here's why this is important. It means your airframe assemblies are built by experienced aircraft specialists . . . men who know no other standards than those of the aircraft industry.

So if you have an assembly you're thinking of subcontracting, call in Twin Coach Aircraft Division for consultation. You'll be secure in the knowledge that it's built by men who think like you . . . *men whose one thought is to produce to specification and on schedule.*

A-9123

TWIN COACH COMPANY
Aircraft Division BUFFALO, N. Y.

FAGEOL AIRCRAFT

OTHER DIVISIONS OF
TWIN COACH COMPANY MAKE:
Fageol Van Trucks, Fageol Gasoline and Propane Engines, Fageol-Leyland Diesel Engines

TWIN COACH AIRCRAFT DIVISION MAKES ASSEMBLIES FOR
GRUMMAN S2F AND UF, BOEING B-52, PIASECKI HUP, REPUBLIC F-84F, AND CLASSIFIED EXPERIMENTAL AIRCRAFT TYPES

REFRASIL INSULATION

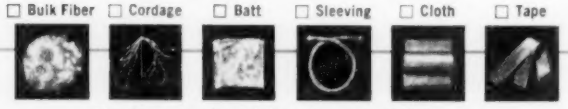
for the shape of things to come!

REFRASIL IS ON THE JOB HERE!

The needle-nosed Douglas X-3 is a forerunner of superspeed aircraft which will soon prove to the world that the sky is no longer the limit! Blistering heat from the twin turbojets of the X-3 are safely insulated from pilot and surrounding structure by Refrasil Lightweight Removable Insulating Blankets, composed of *high silica batt* sandwiched between layers of high temperature foil. Let Refrasil insulate *your* hot jobs! If you require high performance insulation that can withstand temperatures up to 2000°F, you can depend on Refrasil to deliver the *protection* you need! HITCO engineering counsel is yours without obligation. Let's get together on finding new uses for Refrasil in *your* business!

WHAT FORM OF *REFRASIL* DO YOU NEED?

☐ Bulk Fiber ☐ Cordage ☐ Batt ☐ Sleeving ☐ Cloth ☐ Tape



For free sample and literature, check below, clip to your letterhead and mail today!

Your Name _____ AW-1

HITCO

H. I. THOMPSON FIBER GLASS CO.

(Formerly The H. I. Thompson Co.)

1733 Cordova St., Los Angeles 7, Calif.

Telephone REpublic 3-9161

WRITE OR CALL YOUR NEAREST *REFRASIL* REPRESENTATIVE: EASTERN—Fred W. Muhlenfeld, 6659 Loch Hill Road, Baltimore 12, Md., Valley 5-3135 • MIDWEST—Burnie L. Weddle, 3219 West 29th St., Indianapolis 22, Ind., Hickory 8685 • SOUTHWEST—Marshall Morris, 3513 South Drive, Fort Worth, Texas, Webster 2965 • Represented in Canada by RAILWAY & POWER ENGINEERING CORP.

Australian Scheduled International Air Services

	Year ended June 30, 1952	Year ended June 30, 1953	% Change 1953 vs. 1952
Route mileage	34,743	57,870	+66.6
Hours flown	35,180	39,393	+12.0
Miles flown	8,044,989	8,954,411	+11.3
Passengers — paying	43,099	48,000	+11.4
Passengers — total	47,498	52,230	+10.0
Passenger miles — paying	196,937,127	208,306,268	+ 5.8
Passenger miles — total	204,417,285	216,052,636	+ 5.7
Seat miles available	301,945,151	339,884,855	+12.6
Passenger load factor — % paying	62.2	61.3	− 0.9
Passenger load factor — % total	64.6	63.6	− 1.0
Average passenger loading — paying	24.5	23.4	− 4.5
Average passenger loading — total	25.4	24.2	− 4.7
Freight tons	1,156.0	1,248.5	+ 8.0
Freight ton-miles	5,409,915	6,453,446	+19.3
Mail ton-miles	5,640,651	5,519,293	− 2.2
Estimated passenger ton-miles — paying	22,650,079	23,955,221	+ 5.8
Estimated total ton-miles — paying	33,700,636	35,927,960	+ 6.6

Source: Civil Aviation Dept.

Australian Air Force will again have to fight in distant lands and that neither the United States nor the United Kingdom will be able to waste the excellent Australian personnel on second-rate planes. The implication is that in time of conflict the Western powers will see to it that the Australians are equipped with most modern equipment.

In the meantime, RAAF can hardly buy expensive planes with its meager annual allocation of $110 million which, taking into account the expensiveness of locally built craft, cannot serve the aim of modernizing the fleet. RAAF authorities are still bitter about the failure to obtain modern transport planes from the U.S. as it is thought that this is a very urgent and important need.

▶ **Military Transport Needed**—It is believed that some orders, small perhaps, will be placed finally in the U. S. for a good transport plane for the armed forces to replace the now obsolete Dakotas.

Bristol Freighters, although successfully operated by Australian National Airways, did not prove to be ideal for Australian conditions and were recently grounded for a prolonged period. However experts have failed to agree on a desirable U. S. military transport plane and are further hindered by American inability to supply these planes at a reasonably early date.

The RAAF would also like to have some helicopters, but the chance of getting them seems to be slight.

▶ **Sabre Backbone**—For the time being, Australia's leading fighter plane will be a locally built Sabre jet fighter equipped with an English-made engine and with several valuable locally designed improvements.

Under today's conditions this is a good plane, but Commonwealth Aircraft Corp., which is building it, had to overcome a lot of obstacles and delays and mass production is only now about ready to begin. It is understood that the Sabres will cost about £A250,000 each ($562,500) and latest changes introduced comprise a new integral starter motor, new-type leading edges on the wings and improvements of the ammu-

Australian Scheduled Domestic Air Services

	Year ended June 30, 1952	Year ended June 30, 1953	% Change 1953 vs. 1952
Route mileage	86,600	83,389	−3.7
Hours flown	270,619	248,788	−8.1
Miles flown	43,255,674	40,707,871	−5.9
Passengers — paying	1,857,649	1,747,739	−5.9
Passengers — total	1,879,321	1,769,105	−5.9
Passenger miles — paying	745,681,911	697,906,005	−6.4
Passenger miles — total	755,807,124	707,919,897	−6.3
Seat miles available	1,139,542,791	1,086,245,253	−4.7
Passenger load factor — % paying	65.4	64.2	−1.2
Passenger load factor — % total	68.3	65.2	−1.1
Average passenger loading — paying	17.2	18.6	+8.1
Average passenger loading — total	17.5	18.8	+7.4
Freight tons	58,304.9	56,712.8	+0.7
Freight ton-miles	27,337,308	27,876,205	+2.0
Mail ton-miles	1,383,351	1,301,465	−5.9
Estimated passenger ton-miles — paying	74,568,191	69,790,601	−6.4
Estimated total ton-miles — paying	103,288,845	98,968,271	−4.2

Source; Civil Aviation Dept.

SIGN OF DEPENDABILITY

STROUKOFF AVITRUC

A DECADE OF OUTSTANDING ACHIEVEMENT IN AIRCRAFT DESIGN AND PRODUCTION

1945 XG14 Glider
1945 XG14A Glider
1947 YG18 Glider
1948 YC122 Ass'lt Transp't
1949 XC123 Ass'lt Transp't
1950 XG20 Glider
1951 XC123A Jet Transport

THIS RECORD HAS MERITED THE CONTINUED CONFIDENCE OF THE UNITED STATES AIR FORCE AS HAS BEEN MANIFESTED BY THE ASSIGNMENT OF TWO IMPORTANT RESEARCH AND DEVELOPMENT PROJECTS.

THE STROUKOFF INSIGNIA IS A MARK OF ACHIEVEMENT IN THE FIELD OF AERONAUTICS.

Stroukoff Aircraft Corporation

WEST TRENTON NEW JERSEY

nition feed. The guns of the Australian Sabre are also larger than those of U. S. built Sabres (AVIATION WEEK Feb. 8, p. 32).

So far the initial order for 72 Sabres has not been increased and a decision on an eventual increase is unlikely in the near future. It all depends on the world situation at the end of 1954 and of the progress made by CAC with the manufacture of the fighters.

North American Aviation helped CAC with the project to a very considerable extent.

▶ **Canberra Cost**—The high cost of making the Canberra in government-owned factories in Australia is worrying the defense authorities and treasury officials alike. Latest estimates quote over £400,000 ($900,000) as the current cost of locally produced Canberra jet bombers, but independent, reliable observers quote the cost as being closer to £450,000 or more.

The operations of the government-owned aircraft factories are subject to strictest secrecy and it is not known whether the high cost was due to a lagging efficiency or to cost of tooling-up and high Australian wages.

The fact remains that Australian-built Canberras were 60 to 80% more expensive than the same product in an English factory. This led, of course, to serious consideration of the problem as to whether local aviation manufacturing industry should be encouraged.

▶ **Need for Home Industry**—RAAF complained of the high cost of Canberras, but realized that a local manufacturing industry is desirable for emergencies and as a source of spare parts and general maintenance. On the other hand, the industry was not too efficient and has had always to start work on a plane developed abroad at a time when the modern aspects of that particular plane were already subject to doubts based on current research and achievements.

It is a question, the solution of which the Government will have to find in the near future.

Up to the time of writing, RAAF was flying about six Canberras (including the imported ones). The experience was good, but the cost was nevertheless worrying RAAF leaders (for the first time led by an Australian-educated Air Marshal).

Australia seems to be self-sufficient in trainers, with both CAC and de Havilland producing an acceptable pair. Here again it is not expected that orders will be increased.

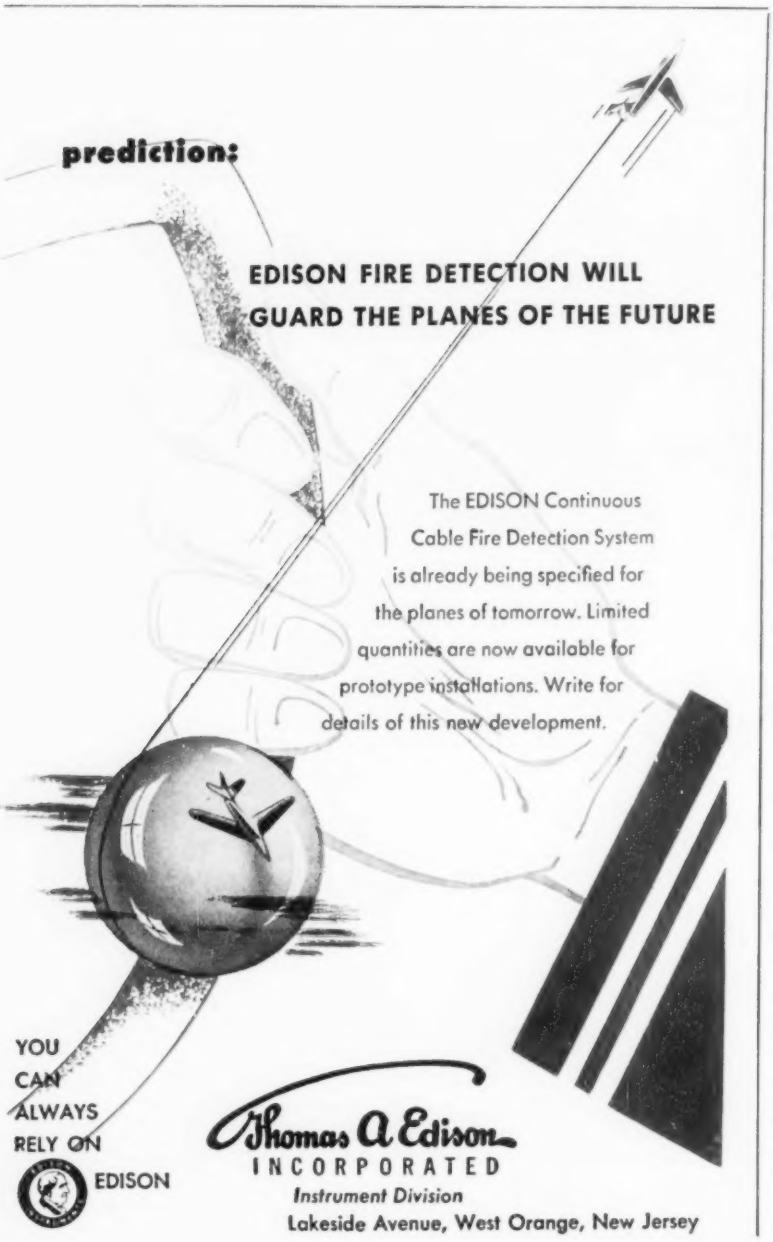
▶ **Pilotless Aircraft**—Modernization will be most pronounced in the field of pilotless planes. Orders for the improved Jindivik are understood to amount to 54 units.

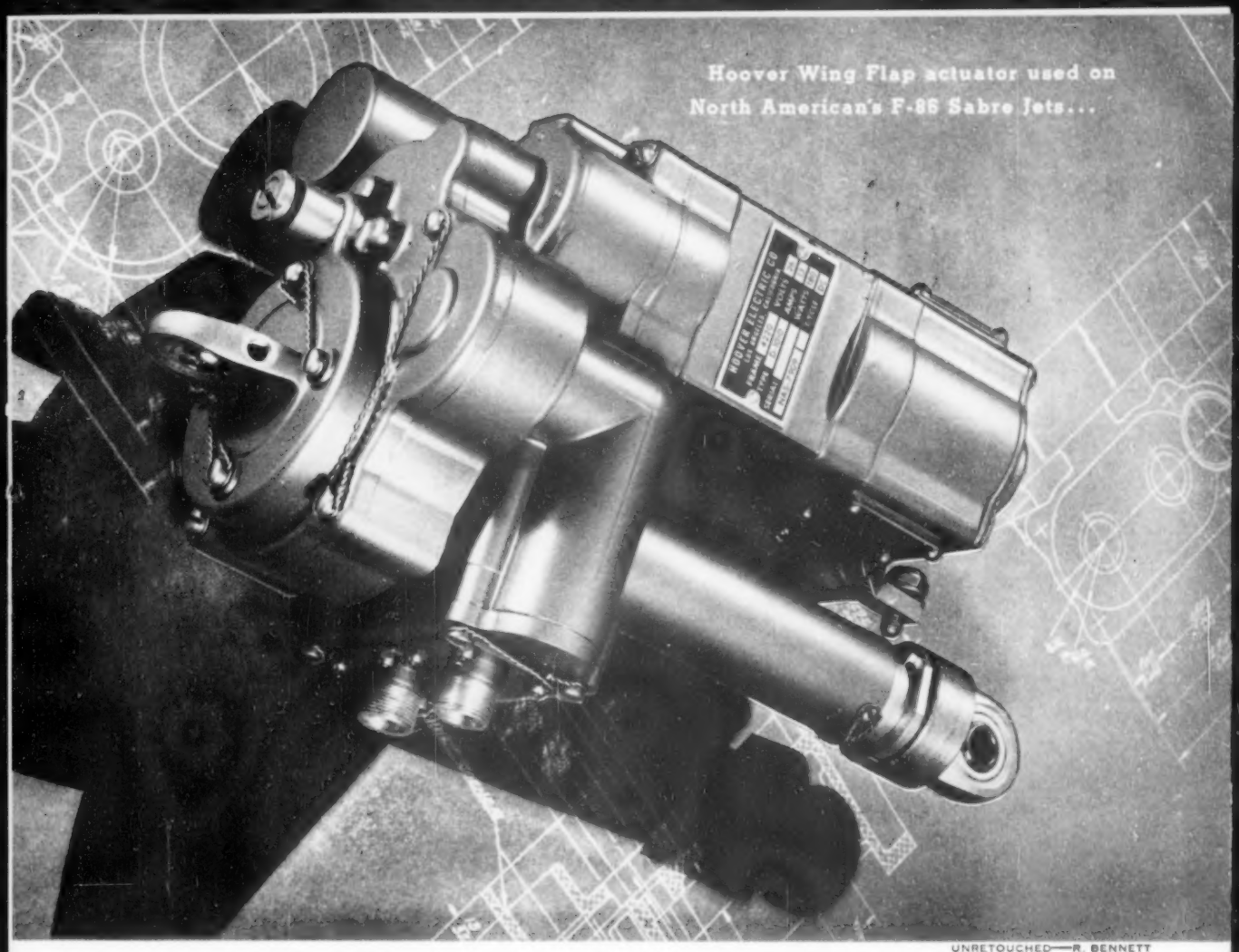
The new Jindivik Mk. 2 will have at least 50% greater power output than the Jindivik Mk. I, of which only 12 were ordered.

There are many plans for the utilization of this small plane, but some experts believe that it will be an excellent expendable bomber with an atomic warhead.

Jindivik will certainly be used fully in conjunction with the newly developed British rockets. The plane is expected to be a relatively cheap proposition, and many federal government officials believe that in the future the Government Aircraft Factories should entirely concentrate on producing this sort of equipment, perhaps even for export to United Kingdom on the understanding that the U. K. will supply Australia with larger modern air craft.

▶ **Rocket Interception**—Out of the pilotless plane developments came a secret and radical plane on which initial experiments are being carried out. It is a delta-wing craft plane for interception of enemy-launched rockets. It is expected to climb at 50,000 feet a minute and reach a top speed of Mach 3. First models will probably carry a pilot (stretched on a foam rubber mattress so that pressures will be equally distributed over all his body). It may fly at heights up to 12 miles and will be


prediction:
EDISON FIRE DETECTION WILL GUARD THE PLANES OF THE FUTURE
The EDISON Continuous Cable Fire Detection System is already being specified for the planes of tomorrow. Limited quantities are now available for prototype installations. Write for details of this new development.
YOU CAN ALWAYS RELY ON EDISON
Thomas A Edison
INCORPORATED
Instrument Division
Lakeside Avenue, West Orange, New Jersey



UNRETOUCHED—R. BENNETT

A DESIGN FOR ACTION

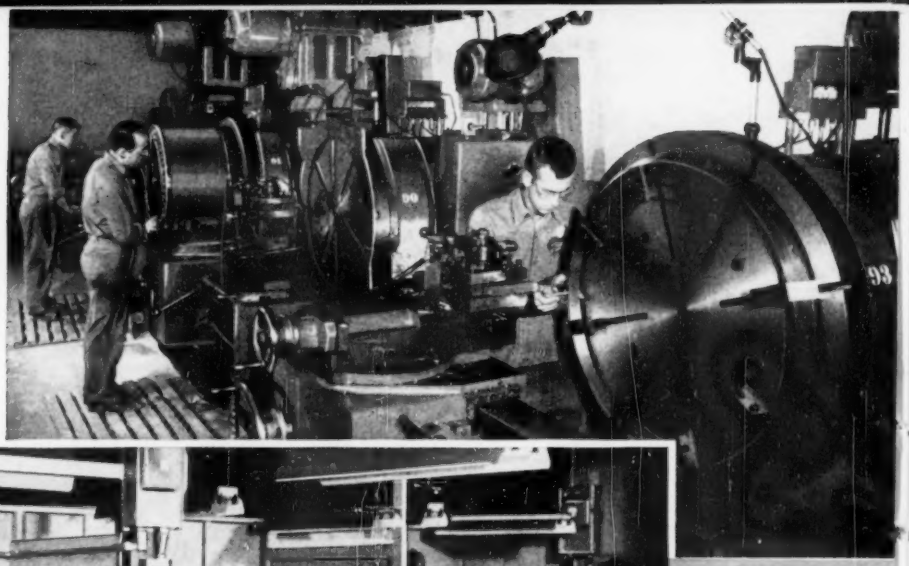
Hoover Electric is proud to have been part of another great year of aviation progress. • Hoover designed and manufactured electric actuators have contributed materially to the outstanding performance of modern jet powered aircraft, as embodied in the North American F-86 Sabre Jets. • We cannot build all of the aircraft electrical actuators but we sincerely believe that we do build the best!

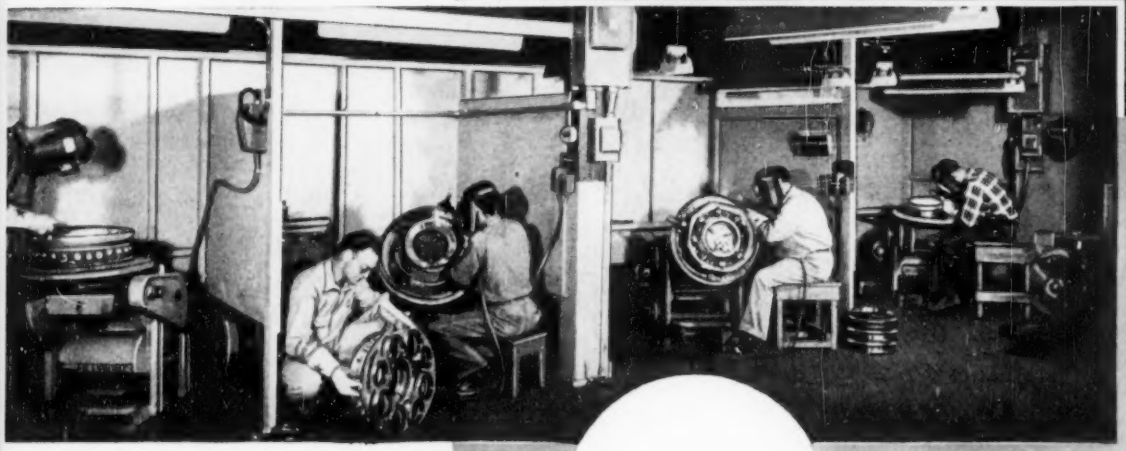
HELCO

HOOVER ELECTRIC COMPANY

2100 SOUTH STONER AVENUE
LOS ANGELES 25, CALIFORNIA

TWIGG





CAN DO IT

PRECISION **fabrication and machining of stainless steel, aluminum, titanium and other high capacity metals to your specifications**

Twigg turns out difficult assemblies for jet and rocket engines . . . and for many other products requiring lightness with strength, high heat-and-corrosion resistance and *precision workmanship.*

Twigg can do it for *you!* We will fabricate and machine high capacity parts and assemblies to your precision and production requirements . . . or will perform single operations for you such as Nicro-brazing, spinning, heat-treating, stress relieving or tube bending.

Write for our colorful new brochure, "Twigg Can Do It", illustrating our complete facilities.

TWIGG INDUSTRIES INC.

DEPT. A-12, BRAZIL, INDIANA

launched from mobile interceptors.

When experiments are completed, the plane may be built in Australia, although its engines probably will be imported from the U. K. It is being tested at Woomera.

Naval Aviation

Naval aviation is developing slowly.

Fireflies and Sea Furies are the Navy's most modern aircraft but plans are advanced for the use of Fairey Gannets (fitted with Twin Mamba turboprop engines) for close-range anti-submarine work and for Sea Venoms for ordinary naval fighter purposes. The question is still not decided, but it is possible that de Havilland will build Sea Venoms in its Bankstown, Sydney, plant. Australian aircraft carriers will be fitted with angled flight decks and with steam catapults.

One aspect preventing the Fleet Air Arm from attaining its plans is the shortage of volunteers for training as pilots. Extensive plans are under way to attract more of the right sort of people to the force.

Export & Import

Australian aviation manufacturing circles are still pressing for more initiative in capturing neighboring markets for Australian planes. They argue that a price reduction of up to 30% will be possible if larger orders are placed.

But considerations against such proposal are numerous. From the political point of view, Australian authorities are entirely unenthusiastic about seeing an Indonesian or other Air Force so close to Australia.

On the other hand, the British aviation industry is unwilling to lose markets, and English influence prevents New Zealand from even entertaining the idea of buying in Australia while it is doubted if the present capacity of Australian production is adequate to cater to exports as well as home needs.

► **Second-Hand Heaven**—In the meantime, Australia is a happy hunting ground for American and other buyers of second-hand aircraft. Civilian airline operators are slowly disposing of their obsolete planes, which are bought for conversion to executive planes in the States, or as meteorological planes (as was the case with a recent load of Mosquitos).

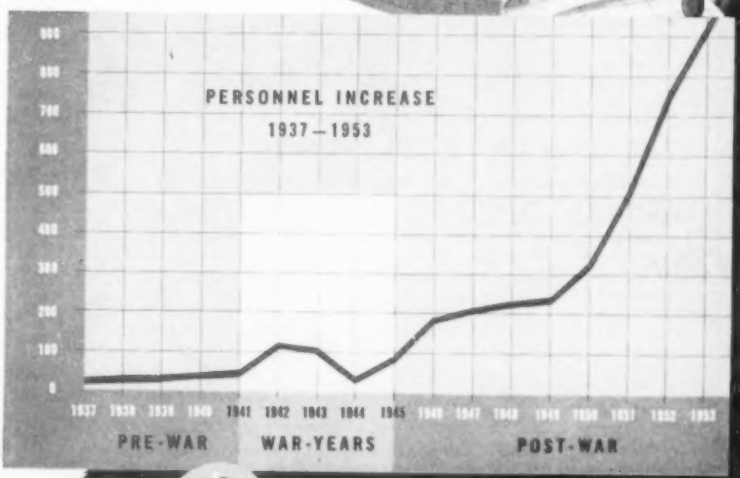
Even greater problems are being faced in the field of imports. ANA's purchase of DC-6s instead of Vickers Viscounts provoke bitter English criticism. So did Qantas' decision to buy Super-Constellations. If Labor is returned to power in the middle-year

There must be a reason...

SINCE 1937, LIBRASCOPE, INC. of Glendale, California, has been offering careers of satisfaction to engineers. There are four major reasons why engineering personnel choose LIBRASCOPE. Foremost is the opportunity to participate in new and ever-changing problems. At LIBRASCOPE you can vary your experience and background and develop your career more quickly in the proper direction. Job security, good pay and full benefits are important reasons too, and, as the chart shows, greatest growth at LIBRASCOPE has been *since* the war-boom, pointing to a sound industrial future for the Company in the analog-digital computer and control instrumentation field.

Engineers — Physicists — Mathematicians for functional development and design of mechanical and/or electrical computers and for systems evaluation and analysis.

Electronic Engineers in the following: computers, analog or digital, magnetics, servos, packaging.



Computers and Controls

LIBRASCOPE INCORPORATED

1607 FLOWER STREET • GLENDALE, CALIFORNIA

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

For a rewarding career with a Company that offers optimum stability with job diversification, write LIBRASCOPE today:

DICK HASTINGS
Director of Personnel
1607 Flower Street
Glendale, Calif.

general elections of 1954, it is certain that its policy will be to buy British rather than American planes.

Civil Transport

Principal Aussie airline operators are preparing for a major reorganization in connection with their modernization of fleets.

Australian National Airways, which is still a leader, and particularly in the air cargo field, has purchased two second-hand DC-6s and has two DC-6Bs on order. The planes proved to be very popular on Australian domestic routes, and ANA's principal competitor, Trans-Australia Airlines was also compelled to charter a KLM DC-6 to meet the opposition.

TAA is expecting its fleet of six Viscounts soon for use on domestic Australian flights. It is not yet known what ANA's next step will be in the modernization campaign, as the privately owned airline is still fearful that a trend toward Labor may mean nationalization of ANA.

▶ **Douglas Fan**—ANA was always a consistent buyer of Douglas planes, and its technical staff likes the big U. S. planes, although considerable efforts are being made to persuade it to turn to Bristol Britannias. TAA, if satisfied with Viscounts, may buy more of them or a later model of a similar plane.

Both airlines will probably have a problem with replacements for their DC-3s on feeder services.

Other Australian airline operators are also interested in a good, cheap, safe and efficient replacement for DC-3s and for smaller planes. The only airline which tried de Havilland Herons is Butler Airline; no other airline seems ready to follow the example.

Last year saw the "rationalization agreement" between ANA and TAA and services were readjusted, with airmail going also to ANA. Recent demands by airline pilots for higher wages and salaries may yet mean an increase in fares and rates and this may affect the traffic.

▶ **Business Pickup**—Following a slack business period in Australia, major airlines have started to participate in a business recovery. Christmas 1953 saw records being beaten by both ANA and TAA. In Australia's traditionally busy pre-Christmas week, the two principal airlines carried over 40,000 passengers and ANA carried in a fortnight over 4-million lb. of air cargo.

TAA's freight was 20% better than its previous best. In one week, Essendon's busy control tower handled 1,386 aircraft movements.

▶ **International Merger**—In the international airline field, the most important events were the prolonged negotiations for a merger of British airlines in the Pacific area. Several plans were formulated, accepted and rejected, and agreements were reported at least four times. The final agreement remains still to be ratified.

Latest reports from usually very well-informed circles claimed that lack of agreement on some points of importance may yet stop the merger.

Qantas has continued development of its services, but BCPA has been looking somewhat anxiously at the steadily developing competition on its routes to North America. Prospects of operating Comets by BCPA were viewed with limited enthusiasm by the airline's chief executives. Furthermore, the return of good and relatively cheap British ocean liners to the Australia-North America route was casting a definite shadow on future air operations on this route.

High hopes are, however, placed on the forthcoming start of "coach fare" flights on this route.

Research

Research activities were limited this year to some work at the Aeronautical

Sound Motion Picture
RESEARCH REPORTS

THE PROBLEM

Research Reports, prepared by prime or subcontractors, perform the vital function of introducing product development, abilities and limitations. In a broader sense, Research Reports properly conceived and effectively presented, will acquaint members of the Armed Forces with current development of the equipment that will be ultimately placed at their disposal. These Reports should not be confused with training aids, since their function is primarily one of information and not instruction. They also can be used to explain product and facilities to procurement officials and other interested parties.

THE SOLUTION TO THE PROBLEM

Wilding experience in the production of commercial and educational films encompasses over a quarter of a century. Its conveniently located studio facilities in Chicago, Detroit and Hollywood include everything necessary for the creation of quality sound motion pictures from the writing of scripts to the developing and printing of the film. Wilding's writers are men of long and varied experience and its directors, cameramen, technical experts and laboratory personnel are the highest skilled in the film industry. At Wilding, all of these facilities are in an organization under one management, where the very important element of security is controlled at all times.

THE APPROACH

While many Research Reports have been prepared in the form of graphic materials, an ever-increasing number of firms are now utilizing sound motion pictures for this purpose. This is not because of any weakness in brochures, booklets or pamphlets, but because of the greater inherent strength of the audio-visual medium as a means of mass communication. Motion pictures, implemented by dramatic action, appeal to both the eye and the ear, and command the audience's undivided attention. For this reason, the information they impart is more deeply impressed on the mind of the viewer and remembered by him for a longer period.

WILDING PICTURE PRODUCTIONS, INC.

1345 Argyle Street Chicago 40, Illinois

TELEPHONE LOngbeach 1-8410 TELETYPE CG1058

ONLY AIR FRANCE

The world's largest airline

FLIES ALL FOUR

The Giant New

SUPER-CONSTELLATION

The fastest and most advanced in trans-Atlantic service, the "Super-Constellation" offers a new concept of speed and luxury aloft.

World's Fastest Airliner

JET "COMET"

The greatest combination of speed and comfort available, the de Havilland "Comet" cuts flying time in half on Air France routes from Paris to Africa and the Middle East.

Swift Jet-Prop

VICKERS "VISCOUNT"

The new Air France Jet-Prop "Viscount" with four Rolls Royce engines brings the capitals of Europe even closer together, flying at 22,000 feet at a cruising speed of over 300 miles per hour.

Double-Decked

BREGUET "PROVENCE"

The only truly double-decked aircraft in commercial use. Two complete passenger decks offer low cost transportation for 107 passengers to the principal cities of North Africa.

THE WORLD'S MOST MODERN AIR FLEET COVERS THE GLOBE

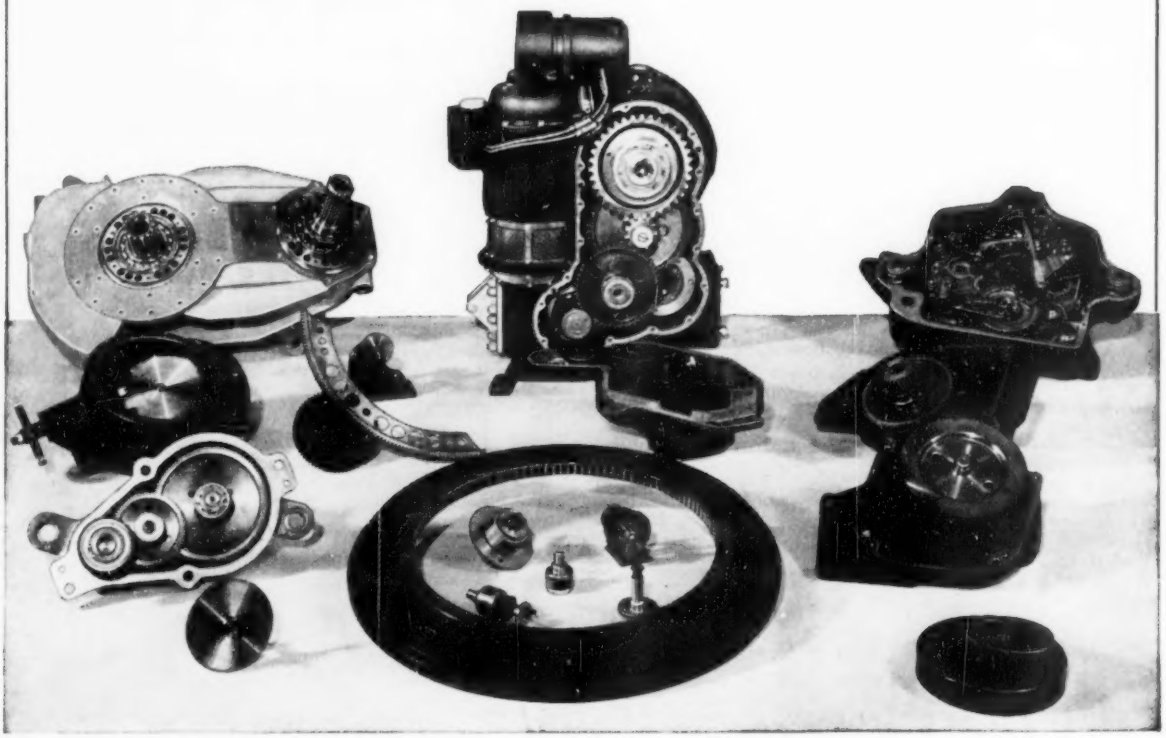
155,000 Miles | 211 Destinations | Six Continents

AIR FRANCE

THE WORLD'S LARGEST AIRLINE

New York, Boston, Chicago, Cleveland, Dallas, Detroit, Los Angeles, Miami, Philadelphia, San Francisco, Washington, D. C., Havana, Mexico City, Montreal, Puerto Rico, Toronto.

STEEL PRODUCTS—
the Source for Gears and Geared Units



Want production of a single gear? A complete geared unit? The Steel Products Engineering Company can do the complete job, under one roof. We have our own engineering staff for design, test and development work, in addition to tool design, manufacture and approved quality control. Our facilities include complete up to date machining equipment, plus plating, heat treating, and welding. If you want precision contract manufacturing in a "package" make Steel Products your source.

THE STEEL PRODUCTS ENGINEERING CO.

ENGINEERS AND MANUFACTURERS • SPRINGFIELD, OHIO

Research Laboratories and to expanding activities at the Woomera station in South Australia.

At the Woomera range the British and the Australians were engaged in testing a new bomb for special use from highspeed high-altitude jet bombers. Strangely enough, a modified nonjet Lincoln bomber was used for these tests. The bomber's inner units were standard Rolls-Royce Merlins, but its outer engines were Armstrong Siddeley Python turboprops so it is able to climb to altitudes about 40,000 feet in relatively fast time. A Canberra jet bomber has also been used.

Other interesting research at Woomera is the current investigation of high-altitude clear-air turbulence, which is of great importance to jet operations.

The valiant part played by the Australian Air Force in Korea has won the admiration of everyone plus a considerable amount of decorations.

A transport unit is also operating in Japan, two fighter squadrons are gaining valuable overseas experience in Malta and a bomber unit, equipped with Lincolns, is hitting rebels in Malaya. It is a good show for the relatively small population of Australia and a mark of their outstanding interest in aviation.—**Marcel Grobtuch**

The Netherlands

Dutch Air Strength Ahead of Schedule

(McGraw-Hill World News)

Amsterdam—The forecast for Dutch airpower this last year could read: "Bright and continued sunny."

Military aviation was on or ahead of schedule. Production was expanding. Commercial aviation beat the previous year's totals.

Air Force

The expansion and modernization of the Royal Netherlands Air Force continued in 1953. In fact, expansion is ahead of planning. It is hoped that the final buildup of 21 fighter squadrons will be completed in 1954.

▶ **Fighter Strength**—The delivery of 150 Gloster Meteor 8 fighters by Fokker Royal Dutch Aircraft Factories is nearly complete and will be fully completed early this year.

The Gloster Meteors of Air Defense Command will, however, gradually be transferred to technical operations, and replaced as fighters by 156 Hawker Hunter F. 1 jets, construction of which now has been started by Fokker with Aviolanda and de Schelde.

Tactical Command has increased its Thunderjet squadrons.

▶ **Bases and Training**—Plans for 1954 include a large-scale expansion and modernization of a number of airfields. New fields will be put into operation, especially at Ypenburg near The Hague.

Further progress will be made with regard to bringing the operational squadrons up to war force. New methods of pilot training, based on American method, have been introduced. The training time has been shortened, but the number of jet hours has been increased.

Although the Air Force has as yet no night fighters at its disposal, personnel is being trained for this special task.

Naval Air Service

The Naval Air Service has been strengthened in 1953. It consists of:

- Light fleet aircraft carrier Karel Doorman, with one fighter squadron (Hawker Sea Furies), one anti-submarine squadron (Fairey Fireflies and Grumman Avengers). There are two reserve squadrons.
- Three anti-submarine squadrons (Fireflies, Grumman Avengers, Lockheed Harpoons and Neptunes).
- Two fighter squadrons (Sea Furies).
- One squadron for miscellaneous services (Austers, Firefly trainers).
- One aircraft rescue squadron (Mitchell

Bronco thrust stand for jet aircraft testing

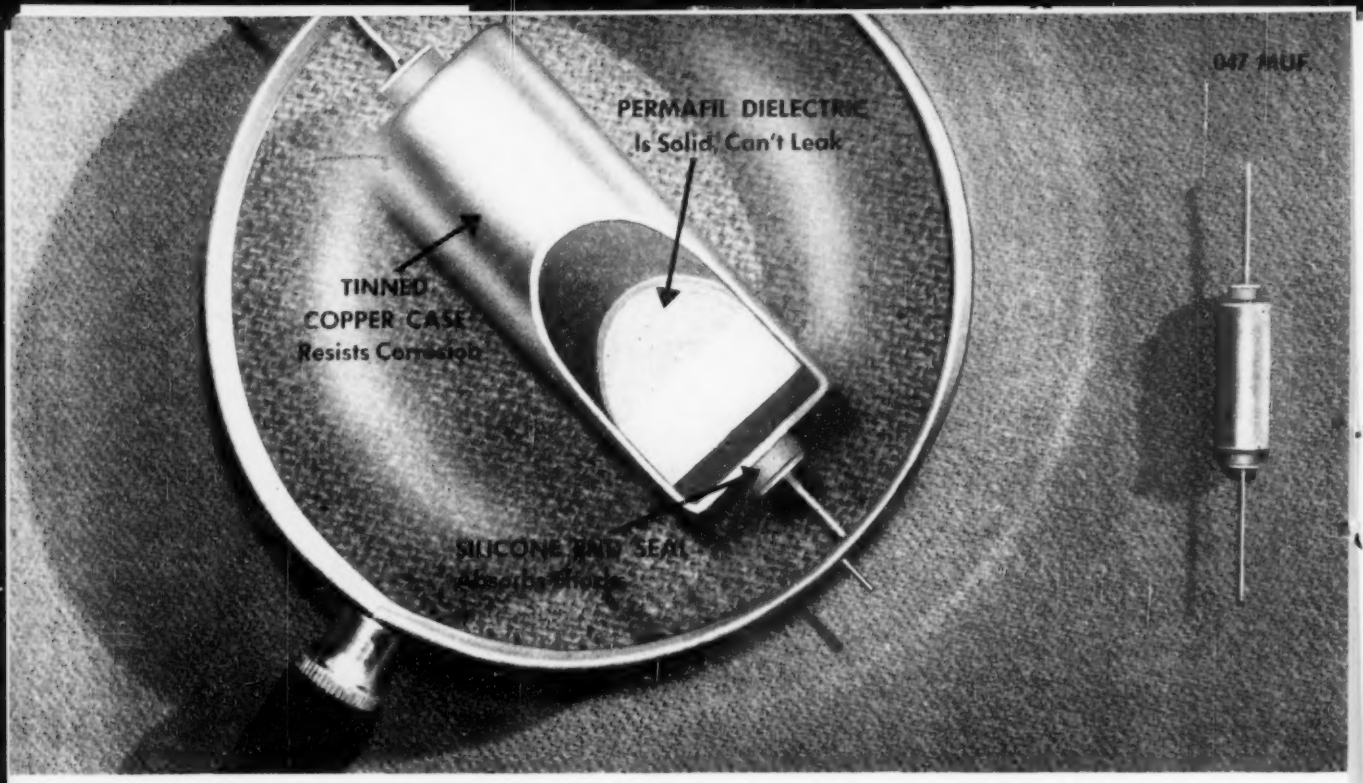
Direct engine thrust measurements, accurate within ½ of one per cent, can be made with this new piece of test equipment. Stands are suitable for both single-engine and multi-engine planes and can be furnished for measuring any specified thrust. Maintenance problems are reduced to the minimum through the use of a closed circuit hydraulic system which permits exposure to inclement weather and extreme temperature conditions.

In addition to the ground level stand pictured above, portable stands of equal accuracy can be furnished. Detailed information on both types is available. Inquiries are invited.

AIRBORNE STORES AND TANKS • AIRFRAME DESIGN • GROUND HANDLING EQUIPMENT TRAINING DEVICES • SERVO MECHANISMS

BRISTOL ENGINEERING CORPORATION
BRISTOL • PENNSYLVANIA

ARMAMENT INSTALLATIONS • ELECTRONIC PACKAGING • RADAR ANTENNAE & DRIVES FIRE CONTROL SYSTEMS • BOMB HOISTS



G-E SUBMINIATURE METAL-CLAD CAPACITORS

With silicone end-seals and solid dielectric operate from −55C to +125C without derating

These G-E subminiature metal-clad capacitors are specifically designed to provide the utmost reliability under severe operating conditions. For over three years, Permafil (solid) dielectric has proved its reliability in aircraft engine control, airborne radio and radar communication equipment, ground radio communication and airborne fire control systems.

G-E subminiature metal-clad capacitors offer two important, unique features:

- **Solid dielectric**—G.E.'s Permafil—provides excellent electrical characteristics and eliminates the possibility of leakage.
- **Silicone end seals**—for high thermal and physical shock resistance exceeding MIL-C-25A requirements.
- **Microfarad ratings** range from .001 to 1.0 uf in voltage ratings of 100, 200, 300, 400 and 600 volts d-c working. They can be operated at full voltage up to altitudes of 50,000 feet.

Case sizes range from .235 inches in diameter and 11/16 inches in length to 1 inch in diameter and 2 5/8 inches in length.

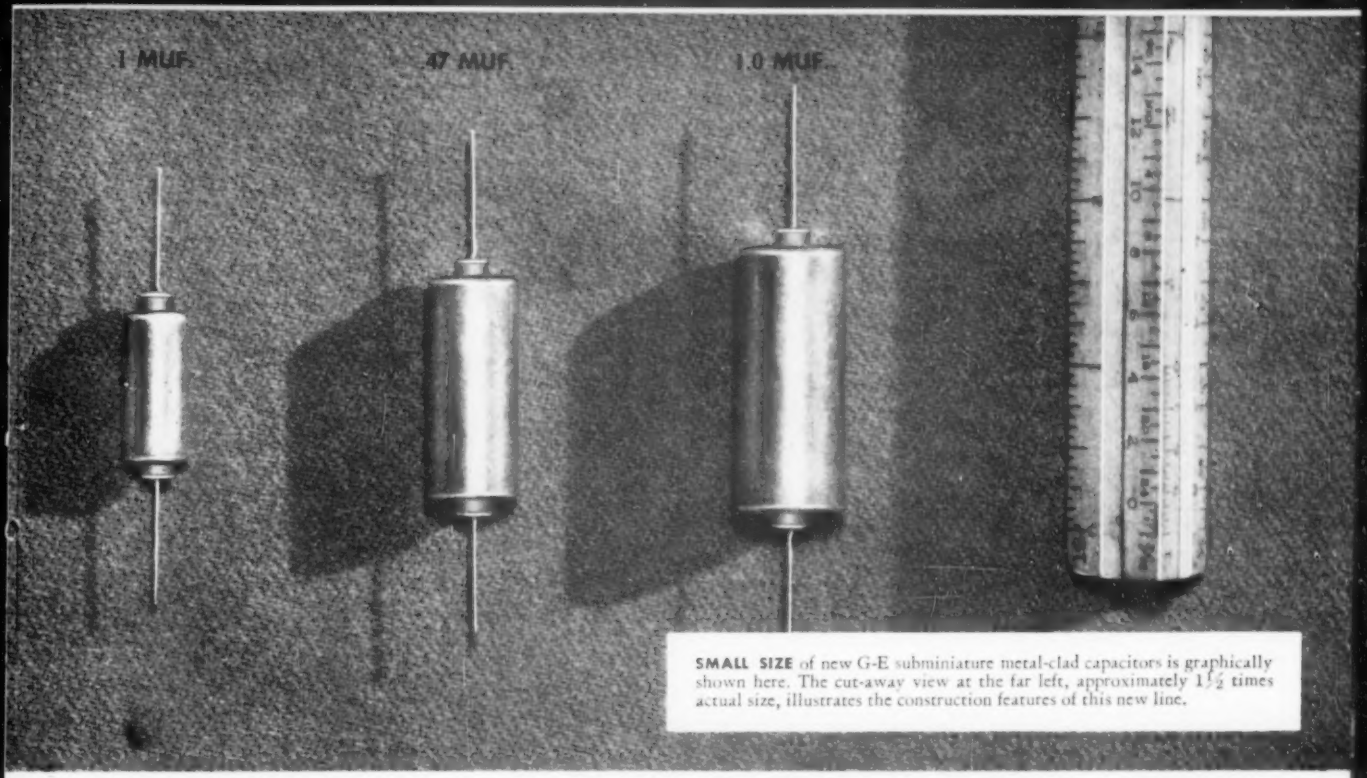
Liquid-filled metal-clad line also available with G-E Pyranol* dielectric for operation from −55C to + 85C without derating. Lower-cost, they incorporate all the operating advantages of the solid dielectric line and are supplied in the same ratings.

For more information see your G-E Apparatus Sales Office, or write for bulletin GEC-987 to General Electric Co., Sect. 442-18, Schenectady 5, N. Y.

*Reg. trademark of General Electric Co.

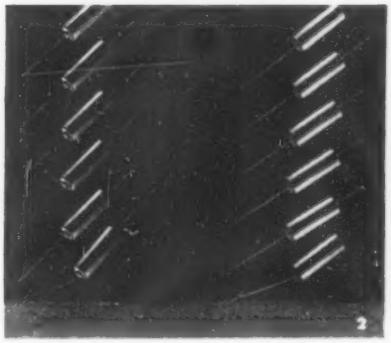
You can put your confidence in—

GENERAL ELECTRIC

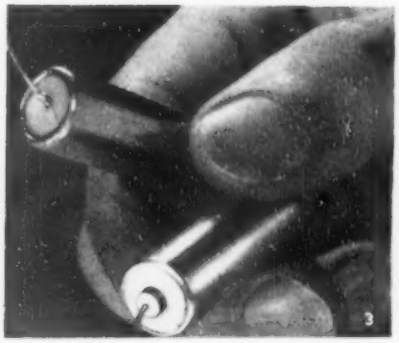


SMALL SIZE of new G-E subminiature metal-clad capacitors is graphically shown here. The cut-away view at the far left, approximately 1½ times actual size, illustrates the construction features of this new line.

1. Solder right up to the case with new G-E silicone end seal—no need to waste ¼ inch of valuable space because of danger of cracking glass.



2. Withstands vibration and rough handling. This view shows a glass-bead-sealed capacitor and a silicone-sealed capacitor being dropped.

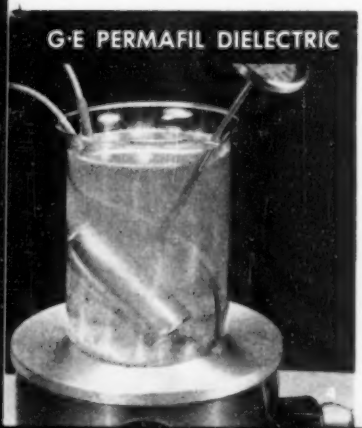


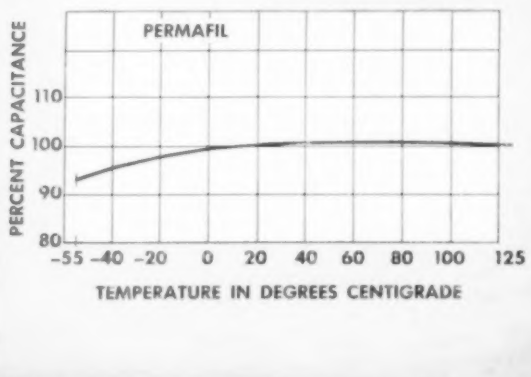
3. Undamaged by dropping, the two capacitors are shown here—note that there are no cracks in the G-E silicone-sealed unit.

4. At +125 degrees centigrade, the capacitor consistently maintains 100 percent capacitance.

5. At −55 degrees centigrade, the subminiature G-E metal-clad capacitor with Permafil dielectric shows less than 7 percent loss in capacitance.

6. Capacitance vs. temperature is shown by this typical curve. G-E capacitors with Permafil dielectric have very little capacitance change throughout the entire range from −55 C to +125 C.



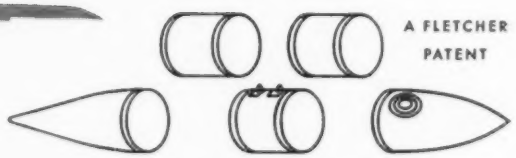


...because someone made his plane fly farther

He flew from bases in Japan. But his F-80 jet carried barely enough fuel to reach Korea and get back. He needed *more time* over his targets.

Quickly, the Air Force asked Fletcher Aviation what could be done. *Answer:* capacity of the unique Fletcher fuel tank could be increased from 165 to 255 gallons, in a hurry. Just remove sections from some tanks and add them to others.

From then on, Bill and his buddies flew their F-80s with fuel enough to triple the time over target—and get home with plenty to spare. Like a lot of others, we're *glad* he's back.



A FLETCHER PATENT

The framers of the Constitution sought to "promote the progress of science and useful arts." With this stimulus, creativity became an American hallmark and—as this incident shows—is the guiding principle at Fletcher Aviation Corporation.

FLETCHER
aviation corporation

190 WEST COLORADO AVENUE • PASADENA, CALIFORNIA
SERVICE OFFICES: DAYTON, OHIO • WASHINGTON, D.C.
OFFSHORE AFFILIATES: OSLO, NORWAY • TOKYO, JAPAN

WORLD'S LARGEST DESIGNERS & MANUFACTURERS OF EXTERNAL WING TANKS

patrol planes, Lockheed Harpoons and a number of Sikorsky helicopters).

A number of Lockheed Neptunes (anti-submarine patrol planes) have just been received from the U. S., as well as a number of Grumman Avengers. A further supply is expected in 1954.

Production

Fokker of Schiphol, near Amsterdam, finished the main part of its Gloster Meteor Mk. 8 order in 1953. The en-192 for Belgium and 156 for the Royal Netherlands Air Force) will be completed early this year.

As the successor of the Meteor, 460 sweptwing Hawker Hunter F. 1 jet fighters will be produced. Of these, 112 are destined for the NATO countries under U. S. offshore procurement, 192 for Belgium and 156 for the Netherlands. Parts of these aircraft will be constructed by Aviolanda (of Papendrecht) de Schelde (of Dordrecht). The engines are to be constructed by Belgium.

▶**Fokker Designs**—The S.14 Mach Trainer Mk. 1 has been tested by many foreign teams. A series of this type is currently under construction for the Royal Netherlands Air Force, and another batch will be built for the Brazilian Government. The S.14 Mk. 2 is now powered with the Rolls-Royce Nene engine; this type is currently being tested by Dutch and foreign missions.

Fokker established a Brazilian-Dutch Fokker company, Fokker Industria Aeronautica S. A., in Rio de Janeiro in 1953. This company will build under license an initial order of 100 S. 11 Instructors, 50 S. 12 instructors, (nose wheel version), and 50 S. 14 Mach Trainer Mk. 1 side-by-side jet trainers for the Brazilian government.

Production started in 1953 of 6 Saab Scandia civil airliners, the first of which will be delivered sometime this year.

Development work started in 1953 on the new Fokker F. 27 Friendship twin-turboprop 28-36 passenger airliner, of which two prototypes are under construction.

Fokker's main 1954 production will be the Hawker Hunter series for NATO forces.

Fokker S.14 Mach Trainer production will be continued and will probably be enlarged by new orders. F.27 construction will be in full swing.

▶**The Lineup**—This will be the Dutch production lineup in 1954:

Fokker's factories will have a capacity of 830,000 sq. ft, and employ 2,200 by May.

• **Aviolanda** has 300,000 sq. ft. and a 1,000-man work force.

• **De Schelde** has 55,000 sq. ft. and 300 personnel.

• **Avio-Diepen** of Ypenburg (repair work) has 86,000 sq. ft. and some 300 personnel.

Civil Aviation

KLM Royal Dutch Airlines suffered a severe loss by the death of its founder and president (on the last day of 1953), Dr. Albert Plesman. No successor is contemplated at present.

Aside from this blow, the year has been a satisfactory one for Dutch aviation.

▶**Traffic Results**—KLM's traffic totals for 1953 show a general improvement over 1952's figures. The following listing compares the two years, with the 1953 results given first, followed by the 1952 figures, and the percentage improvement.

• Distance flown (km.): 48,800,000; 44,700,000; 9%.

• Hours flown: 147,000; 134,000; 10%.

• Available ton-km.: 247,700,000; 240,800,000; 14%.

• Passengers: 600,000; 517,000; 16% (passenger-hrs. in 1953 totaled 1,330,000,000).

• Freight (kilos): 14,990,000; 14,350,000; 4.5%.

"MONOBALL"®
Self-Aligning Bearings

CHARACTERISTICS

	ANALYSIS	RECOMMENDED USE
1	Stainless Steel Ball and Race	For types operating under high temperature (800-1200 degrees F.).
2	Chrome Molly Steel Ball and Race	For types operating under high radial ultimate loads (3000-893,000 lbs.).
3	Bronze Race and Chrome Molly Steel Ball	For types operating under normal loads with minimum friction requirements.

Thousands in use. Backed by years of service life. Wide variety of Plain Types in bore sizes 3/16" to 6" Dia. Rod end types in similar size range with externally or internally threaded shanks. Our Engineers welcome an opportunity of studying individual requirements and prescribing a type or types which will serve under your demanding conditions. Southwest can design special types to fit individual specifications. As a result of thorough study of different operating conditions, various steel alloys have been used to meet specific needs. Write for revised Engineering Manual describing complete line. Address Dept. AW-54.

SOUTHWEST PRODUCTS CO.
1705 So. Mountain Ave. - Duarte, California
(LOS ANGELES COUNTY)

PUSH-PULL CONTROLS
Compression and Tension Type

Aircraft cable is strung with spherical steel shells in a rigid or flexible housing sealed with "O" rings. 3" standard bend radius. ¾" minimum bend radius.

Three Types:

1. Light Duty—Compression Ult. Load 1250 lbs.; Ult. tension 960 lbs.
2. Heavy Duty — Compression Ult. Load 1650 lbs.; Ult. tension 960 lbs.
3. Extra Heavy Duty—Compr. Ult. Load 3050 lbs., Ult. tension 3900 lbs.

Modernize your push-pull control system with Southwest Mechanical Push-Pull Controls. Eliminate bell cranks, pulleys and dual cables. Send for ENGINEERING MANUAL giving detailed prints and complete specifications covering materials, finishes, capacities. Please address Dept. AW-54.

SOUTHWEST PRODUCTS CO.
1705 SO. MOUNTAIN AVE. DUARTE, CALIF.

Super Constellations in service and four more are to be delivered in 1954. Two Douglas DC-6A Liftmasters and 10 Convair 340s are still on order. Of the 14 Convair 340s which KLM will soon possess, six are to be allocated to the West Indies Division.

When all the airliners now on order are delivered (and after the sale of five Constellations and three Convair 240s), KLM in 1954 will have a fleet of 91 aircraft, the majority being of the most up-to-date type.

The KLM network has a total route mileage of 131,850 miles. Several enlargements occurred in 1953. It now serves 102 cities in 67 countries (34 cities in the Western Hemisphere).

► **Miscellaneous Data**—The number of charter flights was about 48% more than in 1952 (325 against 220). In addition 86 emigration flights took place.

In 1953 KLM won first prize in the handicap section of the London-New Zealand air race.

During the weeks following the flood disaster in Holland at the beginning of February 1953, KLM brought in 350 tons of relief supplies from over 30 different countries.

The number of personnel is now 13,545. Flying personnel totals 1,340, including 520 pilots—**Paul Catz.**

Sweden

Defense Strength Is Spread Thin

(McGraw-Hill World News)

Stockholm—In last year's defense budget, the Swedish Army got about all it asked. This year sees a swing back in favor of the Air Force. Of a total defense outlay of just over 2 billion kronor (about $388 million at the rate of one krona = 19.3 cents), the Air Force now gets 34%, compared with only 30% last year. This means the AF gets altogether 689 million kronor.

With the Army now getting 40% and the Navy 20%, the division of funds between the forces is back at the 1952-53 ratio.

► **Seven-Year Program**—In the new budget the allocation for the Air Force seven-year procurement program is raised from 2,105 to 3,150 million kronor (about $600 million). This will enable it to meet the increased costs of new equipment, and makes replacements at a reasonable rate.

The yearly appropriation for equipment purchases is increased by 100 million kronor to 450 millions. Funds will be applied mainly to buying jet fighters from England to replace obsolescent planes, and procuring a new fleet of transports. The number of fighters will not suffice for replacing the Spitfires now used for reconnaissance with more modern aircraft, and over the long period there will be less rather than more fighters in service than there are now.

It may be noted that the most prominent item in Sweden's budget is not defense but social welfare expenditures. This situation will now be accentuated, too, by the introduction of a costly system of compulsory sickness insurance.

Taxes are already too high for the maintenance of a really healthy economy—especially as they are relatively heavy (quite low down) on the income scale. Consequently 2 billion kronor for defense has come to be something of a magic figure in Swedish budgetary thinking. Seeing that air defense is not only growing in cost but also in relative importance, pressure to reduce the Army and Navy share of the defense total is obviously going to increase in the coming years.

► **Strictly Defense**—At present, Sweden's air defense consists mainly of day fighters. There is no retaliatory bomber force whatsoever, and not being a member of NATO, Sweden will not have tactical atomic weapons.

Gen. Bengt Nordenskiold, com-

AUTOMATIC RIVETING!

CHOBERT High-Speed System

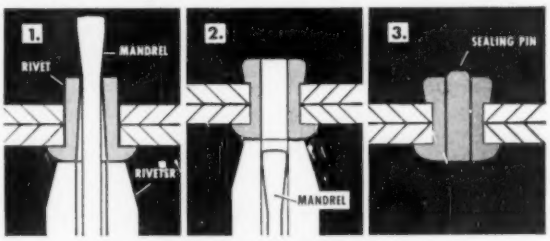
INCREASES PRODUCTION — CUTS COSTS!

FOR ALL BLIND OR OPEN RIVETING • NO SKILLED HELP REQUIRED • FULLY AUTOMATIC • UNIFORM RIVET RESULTS

The CHOBERT High-Speed Riveting System is especially designed for *fully-automatic blind or open riveting.* The pneumatic riveter can place rivets at a rate of 2000 per hour—solves blind rivet problems usually considered impossible with other riveting methods!

HERE'S HOW CHOBERT RIVETS WORK!

1. Insert rivet, automatically held ready by mandrel and jaws of Chobert pneumatic riveter, into proper size hole.
2. Press trigger of riveter. Mandrel draws back expanding rivet to uniform upset and tightness in one complete operation. Next rivet is automatically readied by Chobert Riveter for use.
3. Solid, finished rivet is gas and watertight. Can be used without sealing pin!



Meets Specification AF40911

Manufacturer and Distributor of pip Self-locking, Quick-release Pins and avdel Positive-action Sheet Grippers.

AVIATION DEVELOPMENTS INC. 210 NORTH FRONT STREET • BURBANK, CALIFORNIA

AVIATION DEVELOPMENTS (CANADA), LTD., TORONTO • AVIATION DEVELOPMENTS, LTD., LONDON, ENGLAND

TITANIUM RINGS?

... sure we make them

In 1950 American Welding completed the first successful production flash butt-welding of the new wonder metal — Titanium Alloy. Since that time hundreds of Titanium components have been produced in our plant.

If you use, or are planning to use, fabricated Titanium components, let our Product Development Division study your problem. Our factory is equipped to perform welding, machining, and fabricating of all types of ferrous and non-ferrous metals.
Call or write us today!

THE AMERICAN WELDING & MANUFACTURING COMPANY • 420 DIETZ ROAD WARREN • OHIO

More and more jets keep their oil cool

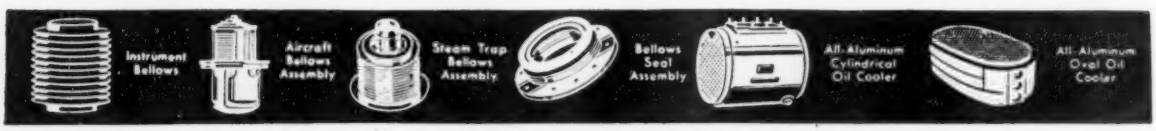
with Feather-Weights

All kinds of jet aircraft get what they need in oil cooling from Clifford All-Aluminum Feather-Weights . . . *the only all-brazed type of oil cooler.* The proved superiority of Feather-Weights comes from two sources: Clifford's patented method of brazing aluminum in thin sections, and Clifford's wind tunnel laboratory, largest and most modern in the aeronautical heat exchanger industry. Your inquiry is invited. CLIFFORD MANUFACTURING COMPANY, 136 GROVE STREET, WALTHAM 54, MASS. *Division of Standard-Thomson Corporation.* Offices in New York, Detroit, Chicago, Los Angeles.

CLIFFORD HYDRON Metal Bellows

ALL-ALUMINUM OIL COOLERS FOR AIRCRAFT ENGINES

HYDRAULICALLY-FORMED BELLOWS AND BELLOWS ASSEMBLIES



mander in chief of the Swedish Air Force, has stated frankly that NATO will have to supply bombers if Sweden is to be defended. In fairness, it should be added that Gen. Nordenskiold has also put it on record that personally he thinks Sweden ought to contribute to Western defense by joining NATO.

But even assuming NATO bomber support, Sweden's 10 day fighter and four tactical plane wings would have a task probably beyond their means—especially if the Russians advanced their fighter bases into Finland and on to the Baltic islands of Gotland and Bornholm.

► **Spread Thin**—Sweden extends about 1,000 miles from north to south, and there are important military areas, communications centers, industrial plants, cities, storage depots, and power stations scattered all over the place.

Something of the dilemma involved was indicated by Gen. Nordenskiold in an address in Gothenburg nearly two years ago. There he said flatly that instead of one day fighter wing which it has now, for adequate defense Gothenburg needs two day wings and one night fighter wing.

No such increase is on the cards, however, although Gothenburg is Sweden's most important port and the only one of any capacity for receiving supplies from the West. Urgings from various quarters to open up an alternative supply route via the Norwegian port of Trondheim have met no response from the neutralist government.

► **No Atom Missiles**—In the circumstances, Swedish defense thinkers are turning their attention more and more to the possibilities offered by guided missiles and atomic weapons. Swedish scientists could doubtless produce atom bombs, but the willingness of the West to assist with these new weapons also hangs a good deal on Sweden's foreign policy line. And without Western aid, at least in know-how, a small country's chances of acquiring them at reasonable costs are slim. Sweden's experience with jet engines shows that.

Sweden needs more anti-aircraft equipment, both of the conventional and guided-missile type. The radar warning system also needs extending. A lot of this is not even in the planning stage, but in any case it will cost a lot of money and will probably entail a considerable rearrangement of the overall defense setup.

The idea of atomic bombs, or at least the cost of them, does not seem popular in the Socialist circles that govern the country. Obviously, however, they would improve the chances of defense against invasion and could provide Sweden with a retaliatory weapon, especially in guided missiles.

► **J-29 and A-32**—In the meantime, Sweden's Air Force is going to have to get along with conventional equipment—and less of it, rather than more. Equipping day fighter wings with J-29s is still in process, and manufacture of engines for the Lansen A-32—with which the four tactical support wings are to be equipped—will not start until mid-1955.

At the most about 200 of the all-weather A-32 appear to have been ordered. Saab is delivering some 600 J-29s, all told, but not all of those delivered are going to the interceptor groups. A number are being used for ground support, and some for reconnaissance.

The J-29 is now approaching obsolescence, anyway, and no new Swedish fighter is in sight. Saab is developing a new type from the handy little delta-wing Draken, but no decision has yet been made as to what engine to power it with. To bridge the gap, the Swedes are looking to purchases of Hawker Hunters and Supermarine Swifts from England.

► **Production Expansion**—To build Lansens, while still turning out J-29s, Saab is adding 10,000 square meters of factory space at its Linkoping plant. Together with some 2,900 sq. mi. of additional hangar space, the cost of this expansion will run to 40 million kronor ($7.6 million).

One reason for the expansion is that the Lansen is a bigger plane than the J-29, and requires more space for production. But Saab also has an eye to possible orders from abroad.

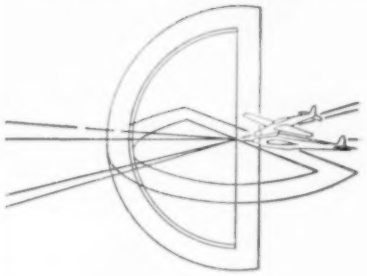
Production facilities are also being expanded at the Flygmotor plant at Trollhattan, where Rolls-Royce Avon 7 jet engines will be built for the Lansen. Here, too, expansion does not necessarily mean that more units will be produced—only that the Avons require many more man-hours. Previously Flygmotor has manufactured de Havilland Goblin engines for mounting in British-built Vampire airframes, and is now engaged on the production of Ghosts for the J-29.

Saab's production of J-29s reached the scheduled rate in 1953. Company sales had then increased fourfold, compared with 1946-48, and turnover rose from 44 million kronor in 1948 to 152 million in 1953. Last year, too, the balance sheet showed an increase from 11 to 79 million kronor in the book value of raw materials, semi-manufactures and work in progress. Compared with 1952, profits had risen from 1.9 to 7.2 million kronor.

Sweden's rather lonely aircraft industry is turning out to be good business.

—G. Howard Smith

Angle of Attack



Precision Controls by TOPP

the heart of . . .

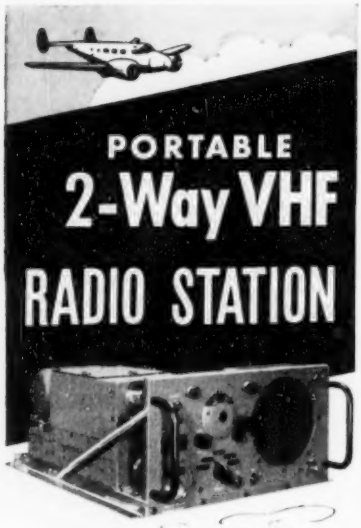
- Landing Approach Control
- Fuel Economy Control
- Fire Control
- Cruise Control
- Climb Control
- Stall Warning

Used by many of the world's fastest aircraft, the TOPP angle of Attack and Yaw control unit *automatically* increases the accuracy of your fire control system. When used as an integral part of other control systems in which angle of attack and yaw information is necessary, the TOPP instruments perform dependably, instantaneously and with precision.

TOPP engineering facilities solicit *your* electronic control problems in both aircraft and missile flight operations. Their outstanding record of dependable performance in the field of precision controls deserves your fullest consideration. Wire or write for information.

TOPP INDUSTRIES, INC.

5255 West 102nd St., Los Angeles 45, California



PORTABLE
2-Way VHF
RADIO STATION

IN A
RUGGED
CARRYING
CASE

Here is new lightweight equipment for ground or shipboard communication with aircraft, or other uses, such as air-ground operation in oil or mining prospecting. The set may be fastened in place in aircraft and connected to an aircraft antenna to supplement the airborne equipment already installed, for special work. The ARC Type 12 operates on a 24 volt power source – the only additional equipment required. 118-148 mc. Both transmitter and receiver are easily portable, in a rugged carrying case. Complete weight, packed, is only 37 lbs. With its sectionalized antenna, it can be set up and be on-the-air in a few minutes.

Assembly consists of ARC Type R-19 Receiver and choice of Type T-11B or T-13A Transmitters, all widely used by Army, Navy and Air Force. Distance range is 50 to 100 miles with aircraft at 3,000 to 10,000 feet. Write for detailed description.

Dependable Airborne Electronic Equipment Since 1928

Aircraft Radio Corp
BOONTON, NEW JERSEY

U.S. Aircraft Industry—1953

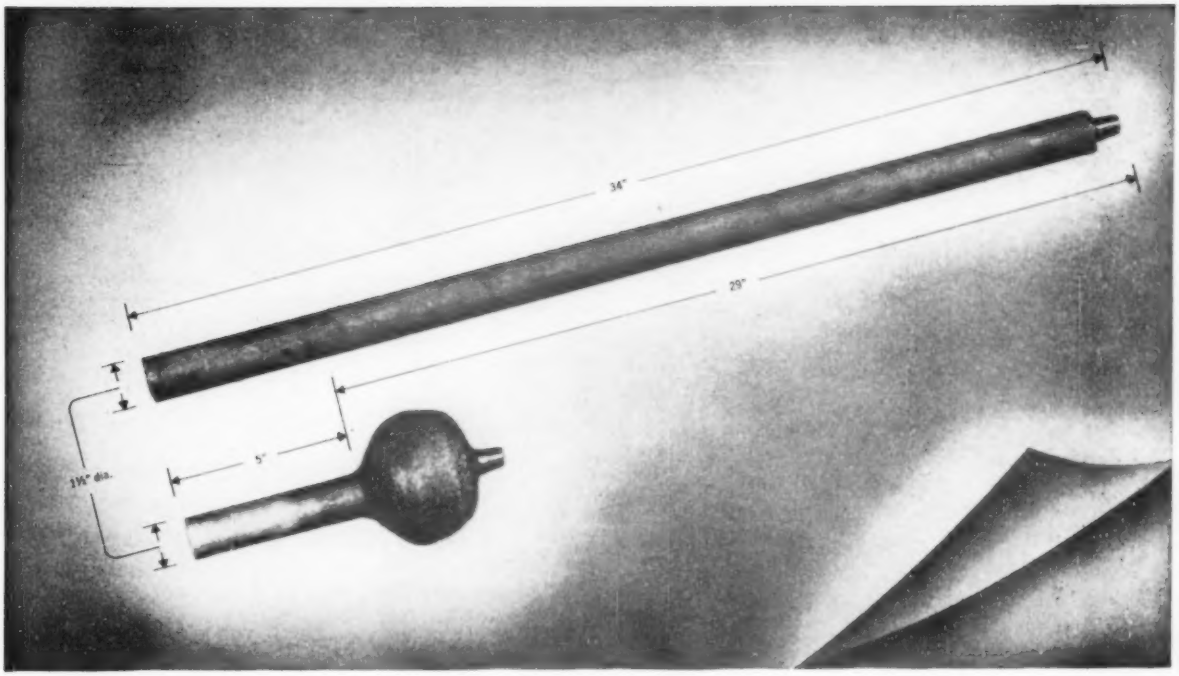
Company	Location	Plant Area (Sq. Ft.)	Plant Employment	1953 Sales ($)	Backlog ($)
Aerocar, Inc.	Longview, Wash.	3,200	10	None	75,000
Aero Design & Engineering Co.	Bethany, Okla.	51,900	500	3,064,000	990,000
Anderson, Greenwood & Co.	Bellaire, Tex.	20,000	70	365,000	361,000
Baumann Aircraft Corp.	Pacoima, Calif.	10,000*	25*	112,000	684,000
Beech Aircraft Corp.	Wichita, Kans.	2,000,000	6,500	140,457,780[1]	.....
Bell Aircraft Corp.	Buffalo, N. Y.	5,000,918	20,358	170,700,000	706,823,873
Boeing Airplane Co.	Seattle, Wash.	11,711,370	63,958	.....	.....
Central Lamson Corp.	Yakima, Wash.	2,445	15	.....	.....
Cessna Aircraft Co.	Wichita, Kans.	1,015,000	4,357	43,560,931	50,300,000
Consolidated Vultee Aircraft Corp.	San Diego, Calif.	11,719,000*	44,723	285,000,000*[2]	1,000,000,000+
Curtiss-Wright Corp.	Wood-Ridge, N. J.	5,176,000	30,000	317,885,461[3]	1,000,000,000[3]
Doman Helicopters, Inc.	Danbury, Conn.	30,000	41	.....	600,000
Douglas Aircraft Co., Inc.	Santa Monica, Calif.	12,511,490	66,500	874,465,000	2,206,000,000
Frederic Flader, Inc.	No. Tonawanda, N. Y.	85,943	218	2,098,718	954,000
Fletcher Aviation Corp.	Pasadena, Calif.	129,050[4]	800	19,590,010	14,346,255
Goodyear Aircraft Corp.	Akron, Ohio	4,043,250	13,000	.....	.....
Grumman Aircraft Engineering Corp.	Bethpage, L. I., N. Y.	2,988,505	11,200	.....	544,709,000[3]
Gyrodyne Co. of America, Inc.	St. James, N. Y.	30,000	98	460,000	1,050,000
Jacobs Aircraft Engine Co.	Pottstown, Pa.	175,000	662	6,750,000	6,000,000
Kaman Aircraft Corp.	Bloomfield, Conn.	174,172	1,200	11,000,000*	30,000,000
Lockheed Aircraft Corp.	Burbank, Calif.	11,600,000	51,548	800,000,000+	1,400,000,000+
Lycoming Div., Avco Mfg. Corp.	Stratford, Conn.	2,500,000	10,000	.....	.....
Glenn L. Martin Co.	Baltimore, Md.	4,500,000	20,000	.....	.....
McDonnell Aircraft Corp.	St. Louis, Mo.	2,580,000	12,200	.....	.....
Meyers Aircraft Co.	Tecumseh, Mich.	45,000	55	127,000	500,000*
Northrop Aircraft, Inc.	Hawthorne, Calif.	3,000,000+	22,500	184,230,018[5]	489,000,000[3]
North American Aviation, Inc.	Los Angeles, Calif.	8,562,000	53,692	634,688,156	1,170,000,000
Piasecki Helicopter Corp.	Morton, Pa.	613,000	4,580	85,000,000*	125,000,000*
Republic Aviation Corp.	Farmingdale, N. Y.	2,300,000	29,000	.....	.....
Ryan Aeronautical Co.	San Diego, Calif.	750,000	4,100	50,000,000	50,000,000
Taylorcraft, Inc.	Conway, Pa.	51,000	95	560,000	150,000
Temco Aircraft Corp.	Dallas, Tex.	1,847,712	5,700	.....	.....
United Aircraft Corp.	E. Hartford, Conn.	10,400,000*	62,000*	579,605,307[6]	1,550,000,000*[7]
Chance Vought Aircraft, Inc.	Dallas, Tex.	2,224,740	13,000	.....	340,000,000
Westinghouse Electric Corp.	Pittsburgh, Pa.	.....	122,700	1,600,000,000*	.....

*—Approximate.
[1] Fiscal year ending Sept. 30, 1953.
[2] For 9 months ended Aug. 31, 1953.
[3] Period ending Sept. 30, 1953.
[4] New 116,000-sq. ft. factory completed Mar. 1, 1954.
[5] For fiscal year ended July 31, 1953.
[6] As of Oct. 31, 1953.
[7] For 9 months ended Sept. 30, 1953.

Source: Industry reports to AVIATION WEEK.

SHIPMENTS BY PLANTS OF COMPLETE CIVILIAN AIRCRAFT AND ENGINES

	Cumulative Totals—January-December		
	1951	1952	1953
Complete aircraft, total airframe weight (thousands of pounds)	5,110.0	9,532.3	10,768.7
By weight of plane			
Under 3,000 lb. airframe weight	1,907.9	2,626.3	3,471.5
3,000 lb. airframe weight and over	3,203.1	6,906.0	7,297.2
By number of places			
1- and 2-place	346.8	2,623.8	3,464.0
3- and 5-place	1,551.1		
Over 5-place	3,213.1	6,908.5	7,304.7
By total rated horsepower, all engines			
Under 100 hp.	78.0	2,623.8	3,464.0
100-399 hp.	1,814.1		
400 hp. and over	3,218.9	6,908.5	7,304.7
Complete aircraft, total number	2,477	3,509	4,134
By weight of plane			
Under 3,000 lb. airframe weight	2,279	3,057	3,825
3,000 lb. airframe weight and over	198	452	309
By number of places			
1- and 2-place	614	3,056	3,822
3- and 5-place	1,661		
Over 5-place	202	453	312
By total rated horsepower, all engines			
Under 100 hp.	150	3,056	3,822
100-399 hp.	2,123		
400 hp. and over	204	453	312
Aircraft engines, number	4,580	5,382	6,647
Aircraft engines, total horsepower (thousands of horsepower)	2,093.8	2,936.7	4,399.2
Value of shipments of plants producing complete aircraft, total (thousands of dollars)	$182,187	.....	.....
Complete aircraft and parts, total	138,017	279,970	340,986
Aircraft, total	88,844	197,151	244,418
Under 3,000 lb. airframe weight	14,201	23,852	33,388
3,000 lb. airframe weight and over	74,643	173,299	211,030
Aircraft parts	49,173	82,819	96,568
All other products (including conversions)	44,170	.....	.....
Value of shipments of plants producing aircraft engines, total (thousands of dollars)	$95,562	.....	.....
Aircraft engines and parts, total	87,632	147,000	154,418
Aircraft engines	25,909	40,722	70,854
Engine parts	61,723	106,278	83,564
All other products	7,930	.....	.....



UPSETTING some old ideas as to the size of UPSETS!

Any good forging handbook will tell you that unsupported steel can be upset only three diameters. But today's new forging techniques at UTICA have revised that. As example, 29" of this Inconel X 1½" bar were upset into the bulb on the end. This bulb, after precise forging and finishing, will become a very high speed turbine wheel with integral shaft.

UTICA electrical upsetting gives special advantages

Today both old and tough *"new"* metals are being upset—on a production basis—in UTICA's battery of upsetting machines. Many special forging advantages result—and unique product design gains too. Primarily the upsetting brings greater strength and ruggedness through controlled grain flow. It also makes new designs possible—designs previously impractical. Most important of all, it drastically reduces not only material costs but machining time and costs as well.

A product of the UTICA "Quality First" program

This is just one development in the long range UTICA program—which combines new methods and new machines to mass produce quality forgings...accurate to a very few thousandths... many produced from the *"new"* hard-to-handle metals. Today UTICA production covers jet blades and other defense items—perhaps tomorrow we can serve you with some of the great forging advances developed during the past few years.

Jobs available for technically trained personnel.

Our new folder "File Facts on Precision Forgings" outlines UTICA'S methods and facilities. Send for your free copy today. No obligation.

PRECISION····

U TI CA

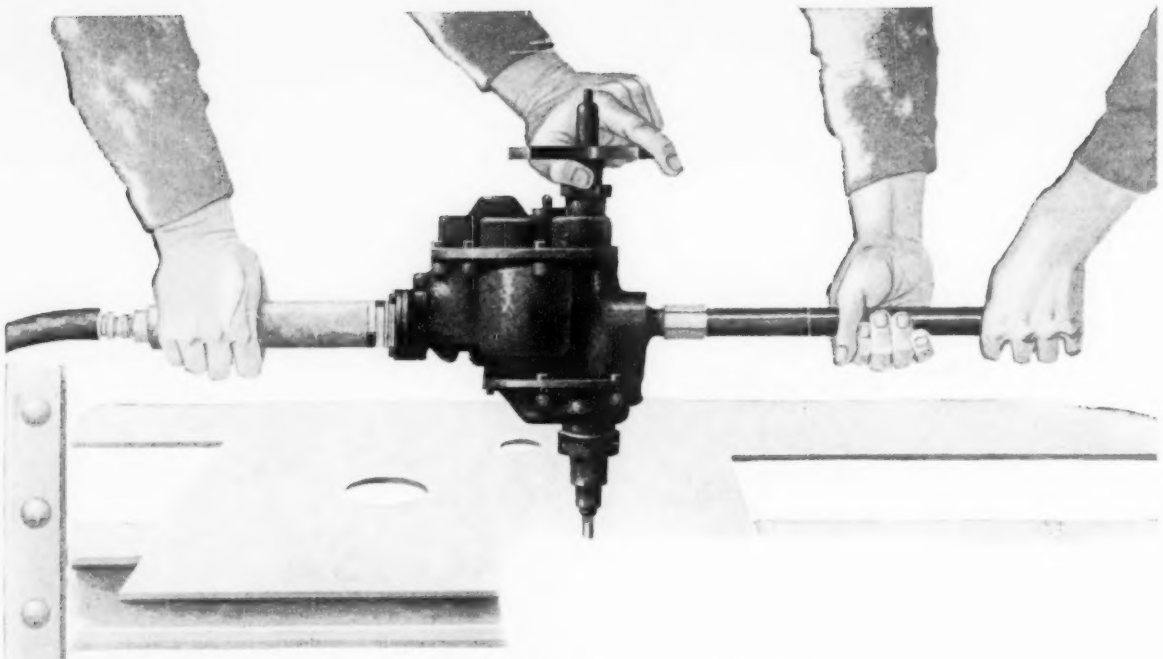
TRADE MARK

····FORGINGS

UTICA DROP FORGE & TOOL CORPORATION

UTICA 4, NEW YORK

MAKERS OF THE FAMOUS UTICA LINE OF DROP FORGED PLIERS AND ADJUSTABLE WRENCHES



Need high capacity, long service life, small size?

here's how leading manufacturers of pneumatic tools get them with NEEDLE BEARINGS

Torrington Needle Bearings are used in many leading brands of pneumatic tools because of their ability to take heavy loading, their compactness, and their long life.

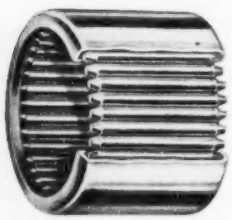
In wrenches, nut runners, drills, rivet hammers, impact and many other types of air-driven tools, the Needle Bearing's ability to boost power output and torque, while saving weight and space, has been proved again and again.

On spindles, idler gears, planetary gears and angle attachments, Needle Bearings enable tool designers to keep tools compact and light. They cost little more than plain bearings, yet they give high-capacity performance over long periods with minimum maintenance.

Throughout industry, Torrington Needle Bearings have become "standard equipment" since their introduction nearly twenty years ago. When space is limited and high capacity is a "must," specify Needle Bearings.

Why not learn whether the Needle Bearing can benefit your products. Our engineers will be glad to assist you.

THE TORRINGTON COMPANY
Torrington, Conn. • South Bend 21, Ind.



TORRINGTON NEEDLE BEARINGS

Needle • Spherical Roller • Cylindrical Roller • Tapered Roller • Ball • Needle Rollers

Trade-marks of leading pneumatic tool manufacturers whose products enjoy the benefits of Needle Bearings.

Ingersoll-Rand · Mall · Buckeye Tools · CLECO AIR TOOLS · Porter-Cable · K KELLER TOOLS · SUNDSTRAND · Milwaukee · Thor · NS NATIONAL AIR SANDER · Rotor Tool · ARO

NEWS DIGEST

Domestic

World's speed record is held officially by North American Aviation's F-100 Super Sabre with a mark of 755.149 mph., Federation Aeronautique Internationale has ruled. The F-100 set the record Oct. 29 in two runs over a 15-km. course at Salton Sea, Calif., during a speed battle with Douglas Aircraft's F4D Skyray, holder of the 3-km. 753.4-mph. mark (AVIATION WEEK Nov. 9, p. 14).

Rapid Senate confirmation of Navy Secretary Robert B. Anderson's nomination as Deputy Secretary of Defense was expected last week. He will succeed Roger M. Kyes, who has resigned effective May 1.

RF-84F Thunderflash, photo-reconnaissance version of Republic Aviation Corp.'s F-84F jet fighter, is entering volume production at the aircraft builder's Farmingdale, N. Y., plant. The jet has air-intake ducts at the wing roots to permit nose camera installations, mounts four .50-caliber machine guns. USAF has taken first deliveries on the RF-84F.

American Airlines will begin installing Bendix Aviation's ignition analyzer No. 11-3365-1 in its 25 DC-7s during April or May.

Beech Aircraft Corp. has received a supplemental USAF contract for 50 additional T-34A trainers, extending present production rate to August 1955. Beech also is building T-34s for Japan and Chile.

North American Airlines' secretary-treasurer, Stanley Weiss, left last week for Vienna to continue negotiations with the Austrian government on formation of Austria's proposed national airline (AVIATION WEEK Mar. 8, p. 52). The nonsked is interested in supplying equipment and crews.

Assembly lines at Sperry Gyroscope Co.'s paralyzed Lake Success, N. Y., plant began turning out full production last week, freed by striking engineers who opened their picket lines to 14,000 union electrical workers. The Engineers Assn. called the walkout two weeks ago in a demand for a 15% wage increase (AVIATION WEEK Mar. 8, p. 7).

Francis H. McAdam has resigned as CAB trial attorney to join Mayer, Meyer, Austrian and Plant, Chicago law firm that handles United Air Lines' account.

New York Airways has cut its helicopter passenger fare between New York's La Guardia and Newark Airport terminals from $15 to $10.

Camille (Rosie) Stein, 51, longtime official and a director of Northwest Orient Airlines and one of the first women to hold a job in U. S. civil aviation, died Mar. 8 in St. Paul.

F. G. Dawson, executive assistant to Sikorsky Aircraft's general sales manager, died Mar. 8 at Westport, Conn. He was 61.

Financial

Curtiss-Wright Corp., Wood-Ridge, N. J., reports net income of $11,402,791 for 1953 from sales totaling $438,728,482, compared with the preceding year's $9,047,514 net and $326,183,643 in sales. Present backlog: more than $865 million.

Ryan Aeronautical Co., San Diego, had a net profit of $595,033 during the first quarter of fiscal 1954, approximately the same as the first period last year. Sales and other income totaled $11,564,917. Ryan's forecast for the year: "continued high level of business."

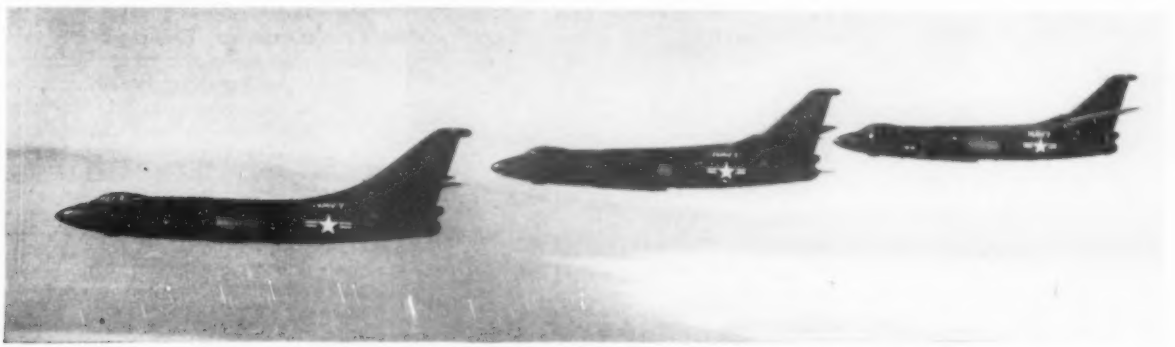
Hiller Helicopters' net income last year totaled $247,637, a drop of $369,422 from 1952. Sales and other income for the Palo Alto, Calif., copter builder added up to $10,414,641 compared with $14,414,024.

Boeing Airplane Co.'s directors have proposed a two-for-one split of capital stock, subject to approval of shareholders at an annual meeting Apr. 27.

International

Dassault Mystere 4-B has exceeded the speed of sound in level flight at 25,000 ft., reports test pilot Constantine Rozanoff. The French jet fighter is the first produced for NATO in Western Europe to crack Mach 1 without the aid of a dive.

Canadair has received a $24-million order from the Canadian government for 100 additional F-86 Sabre fighters powered by Avro Orenda jet engines and possibly armed with rockets and air-to-air guided missiles now being developed in Canada. The Montreal company already has built 900 Sabres under license from North American Aviation.



First View of Douglas Skywarriors in Formation

Production model Douglas A3D twin-jet Navy bomber leads two experimental XA3D-1s in a formation flight over California's Mojave desert. The carrier-based A3D recently was named the Skywarrior. Production Skywarriors are fitted with P&WA J57 turbojets in the 10,000-lb.-thrust class slung in pods under the swept wings. Each of the three planes shown in the above photo differs slightly, particularly in engine cowling configuration. Note tail guns mounted on center Skywarrior. Douglas notes that the A3D has been designed to operate from Navy carriers presently in operation as well as from the new, larger Forrestal class now under construction.

Colonial Asks New Merger Bids

Eastern employes dump 100,000 shares of smaller firm: NAL, Mohawk try to block Rickenbacker move.

Presidential veto of the Eastern-Colonial Airlines merger (AVIATION WEEK Mar. 8, p. 51) caused strong reaction throughout the industry last week.

Here are the developments:

• **Colonial** invited EAL and National Airlines to submit new bids.

• **Eastern** ordered its employes and directors to sell all Colonial stock, prompting Laurence S. Rockefeller, holder of the largest single block of stock (26,200 shares), and others to sell immediately the 100,000 Colonial shares concerned.

• **National** petitioned Civil Aeronautics Board to proceed with hearings on a Colonial-National merger and asked CAB to restrain Eastern from bidding for Colonial until such hearings are completed.

• **Mohawk Airlines** asked CAB to restrain EAL from bidding for Colonial until the National hearings are completed.

• **Interest** in Colonial stock was aroused outside the airline industry.

• **The Board** ordered Eastern to show cause within 10 days why it should not be directed to terminate control of Colonial and why it should not be directed to cease and desist from acquiring control of the smaller airline or any of its routes or assets "without prior approval of the Board."

Capt. Eddie Rickenbacker, EAL board chairman, was known to be highly miffed at the President's decision and was reported even more determined to merge with Colonial at any cost.

▶ **Action Considered**—Meantime, Justice Department was reported to be considering action against Eastern for its premature control of Colonial, the factor that caused the President to veto the merger agreement.

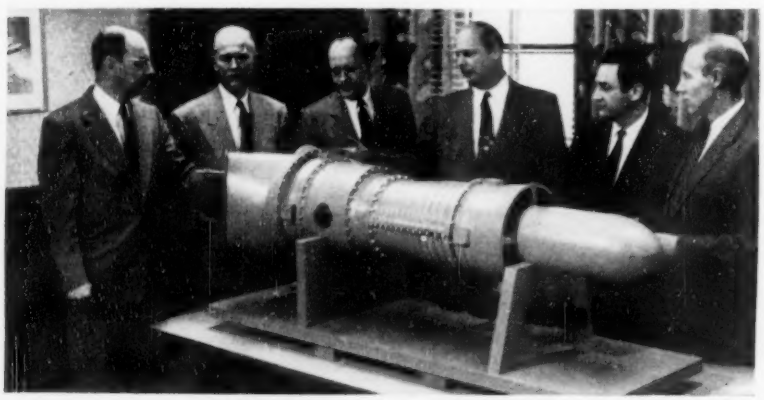
Because EAL's controlling ownership of Colonial stock was "unlawful" under the terms of the Civil Aeronautics Act, the Justice Department could—after CAB filed an injunction against the airline—initiate action against Eastern.

Following Eastern's decision to divest itself of all Colonial shares Mar. 5, the Stock Exchange reported hurried selling of Colonial stock. The stock immediately was affected, rising from 11⅞ to 12¾ at the close of the day last Tuesday. Its high has been 14 this year.

▶ **New Bids**—Colonial's board of directors was scheduled to meet in New York last week to open sealed bids solicited from Eastern and National. CAB was expected to act on the National and Mohawk petitions before the week end.

No indication was forthcoming from the Board as to how it might move in the matter, but in its order reporting the President's veto, CAB noted it would continue the National-Colonial merger hearings.

Mohawk favors continued hearing of the Colonial merger case because it wants the short-haul, local service routes of the present Colonial system. Thus it filed a petition at the same time National did last week, asking the Board to restrain Eastern from bidding for Colonial until the hearings are concluded.



GE Previews Baby Jet

First photo of General Electric's new XT58 gas turbine, designed for Navy BuAer primarily as a helicopter powerplant, shows a mockup of the engine being viewed by members of GE's recently formed Small Aircraft Engine Dept. Only company comment on the XT58's power is that it is "six to eight times as powerful" as a family car engine. Grouped by the turbine, left to right: L. I. Asher, manager of finance; L. T. Callahan, manager of manufacturing; J. P. Turner, Jr., manager of marketing; J. S. Parker, general manager; E. Woll, manager of engineering, and H. T. Hokansion, XT58 project manager, who will direct design, development and applications.

House Passes CAA, CAB Budgets for '55

The House has approved fiscal 1955 budgets for Civil Aeronautics Administration and Civil Aeronautics Board without significant change in the Eisenhower Administration recommendations (AVIATION WEEK Jan. 25, p. 14).

The House took these actions:

• Passed a $103,750,000 CAA budget. This is $135,000 below the Administration recommendation. Of the cut, $100,000 was for operation and maintenance of Alaskan airports. The $550,000 allowed for this activity is $50,000 more than the $500,000 provided for the current fiscal year. The remaining $35,000 was trimmed from the appropriation for administrative expenses in the air navigation and development program, leaving $50,000.

The House approved $1 million, the amount requested, for Commerce Department participation in the research and development work of the Air Navigation Development Board.

• Approved $40 million to CAB for airline subsidy payments. Added to an $8-million carryover, this will permit payments at a rate of $6 million a month until Mar. 1, 1955. The Board's request of $73 million for the entire year contemplated payments at this rate.

In House debate it was made clear that subsidy requirements beyond Mar. 1 will be considered early next year (AVIATION WEEK Mar. 8, p. 12). Two attempts by Rep. John Rooney to reduce the figure to $23 million failed, first on an 86-to-40 standing vote and then on a 265-to-105 roll call vote.

• Approved the $3,777,000 asked for CAB operations. This is $27,000 more than the Board's current budget to provide for handling of airline subsidies, a task acquired last fall when subsidies were separated from airmail pay.

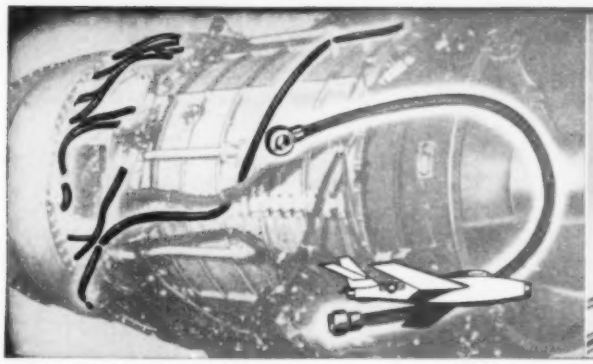
The $103 million provided for CAA is $35 million below this year's $138 million (AVIATION WEEK Mar. 1, p. 12). Because Administration requests were so low, the House made no further reductions in these CAA estimates:

• Salaries and expenses, $96,450,000, compared with about $105 million for the current fiscal year.

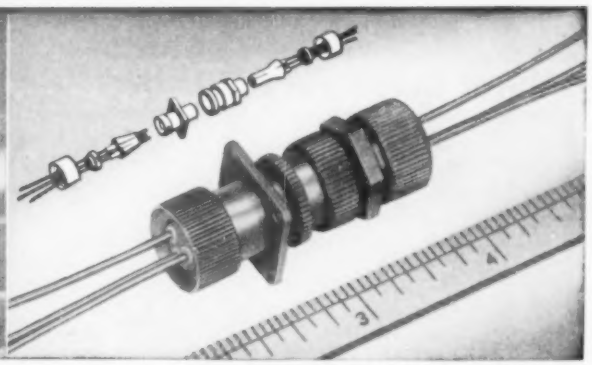
• Establishment of air navigation facilities, $5 million, compared with $7 million for fiscal 1954.

• Technical development, $700,000, compared with $750,000 for 1954.

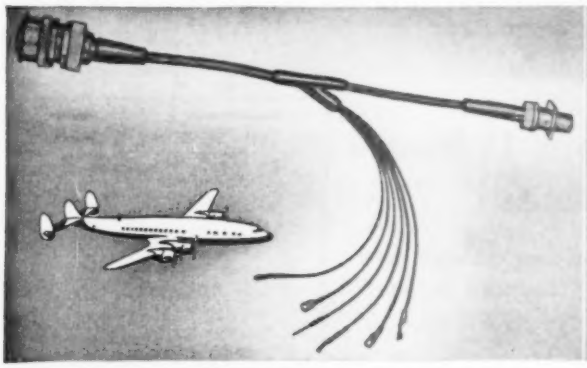
Four design ideas you can use right now...



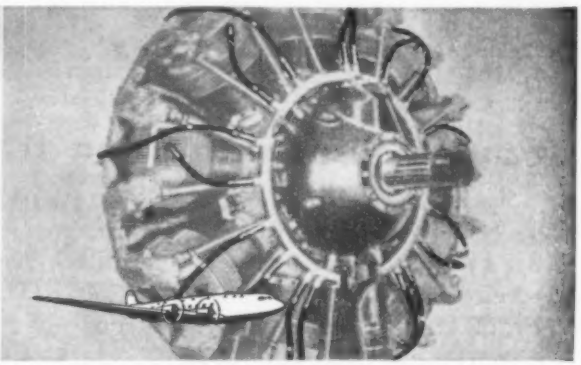
DEPENDABLE FUEL FEEDING. Fuel for the J65 Turbojet Engine is injected to the burners through Titeflex® flexible metal hose. Tough, lightweight Titeflex—tested for temperatures from —70°F. to +600°F. and for pressures up to 500 psi—reliably conveys fuel to engine nozzles; withstands vibration and rough use; is excellent for complex configurations.



FAILURE-FREE INSTRUMENTATION. Designed primarily for instrumentation service at high altitudes, lightweight Titeflex 07 Connectors are pressure-tight and resistant to moisture and corrosion. Plug and receptacle, mated, weigh only 1/3 of an ounce! Special sizes, meeting AN Specifications, can be made with 2 or 3 pins and AE threads—and adapted to your design.



CUSTOM WIRING SYSTEMS. Titeflex specializes in designing and building special "packaged" wiring systems and component assemblies for today's complex aviation and guided missile installations. These may be jacketed with protective silicone or other compounds—and Titeflex Special Connectors used as integral parts solve complex wiring problems.



RADIO SHIELDING. Titeflex Harness for reciprocating engines is our specialty. Titeflex makes a wide range of standard ignition harnesses meeting rigid aviation specifications—can also supply component parts, such as serviceable leads for military and commercial aircraft. Titeflex application on Wright R 1820 Engine includes harness and leads.

FROM DESIGN TO FINISHED PRODUCTS, Titeflex is especially well qualified to help you with all problems of special metal hose, wiring and connections. Take advantage of the long experience of Titeflex engineers in developing high temperature fuel lines, in designing and fabricating harness and wiring systems. Write us now about your application; our nearest representative will be glad to call and help you. Or send for our *new 48-page Metal Hose Catalog* No. 200.

Let Our Family of Products Help Yours

Titeflex

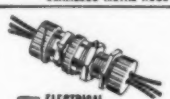
✓ Check products you are interested in.

☐ SEAMED AND SEAMLESS METAL HOSE

☐ PRECISION BELLOWS

☐ IGNITION HARNESS

☐ IGNITION SHIELDING



☐ ELECTRICAL CONNECTORS

☐ RIGID AND FLEXIBLE WAVE GUIDES

☐ WIRING SYSTEMS

☐ FUSES

TITEFLEX, INC.
517 Frelinghuysen Ave.
Newark 5, N.J.

Please send me without cost information about the products checked at the left.

MAIL COUPON TODAY

NAME _____

TITLE _____

FIRM _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____

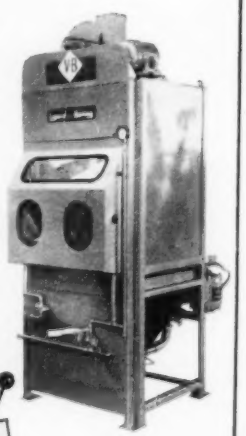
Reduces Finishing Time from 11 hours to 2 hours, 17 minutes!

An 11 hour finishing job on a machined aluminum diffuser now requires ONLY 2 HOURS and 17 MINUTES — with VAPOR BLASTING — resulting in a final finish of 50 to 55 RMS!

Your plant, too, has many metal finishing operations that could be cut to a fraction of their present cost — with Vapor Blast Equipment. You can be sure of great savings in time and labor, increases in production speed, and continued higher profits, with Vapor Blasting. Let us help you prove it.

HOW MUCH CAN YOU SAVE WITH VAPOR BLASTING?

It costs you nothing to find out how superior the Vapor Blast Method is, how easily it will reduce costs and improve your product. Simply send a part to our research laboratory for finishing. We will supply you full data report and you compare it with your own time records for doing the same work on the same part.



VAPOR BLAST MODEL 3030, TYPE B20.

One of five standard models. Custom machines also built to order.

"VAPOR BLAST" is a trademark
"LIQUID HONING" is a trademark

VAPOR V-B BLAST
MILWAUKEE, WISCONSIN

VAPOR BLAST MFG. CO.
3047-C W. Atkinson Avenue
Milwaukee 16, Wisconsin

Just have your secretary drop us a note telling when your sample part will be shipped for Vapor Blast laboratory finishing and analysis.

You can prove SAVINGS on production jobs like these with Vapor Blast Liquid Honing:

- ☐ Aircraft Engine Overhaul
- ☐ Color Anodizing
- ☐ Blanking
- ☐ Brazing
- ☐ Cylinder Honing
- ☐ Deburring
- ☐ Decorative Finishes
- ☐ Die Cleaning and Finishing
- ☐ Diesel Engine Overhaul
- ☐ Drawing
- ☐ Electroplating
- ☐ Electropolishing
- ☐ Engine Overhaul
- ☐ Forming
- ☐ Forging
- ☐ Functional Finishes
- ☐ Fluorescent Penetrant Inspection
- ☐ Glass Mold Cleaning and Finishing
- ☐ Lubrication
- ☐ Machining and Grinding for Finish
- ☑ Metal Finishing
- ☐ Magnaflux Inspection
- ☐ Micro-Inch Finishing
- ☐ Parco-Lubriting
- ☐ Parts Cleaning and Salvaging
- ☐ Phosphating
- ☐ Plastic Mold Cleaning and Finishing
- ☐ Rubber Mold Cleaning and Finishing
- ☐ Scale Removal
- ☐ Stamping
- ☐ Surface Finishing and Polishing
- ☐ Tool Honing
- ☐ Tool Inspecting
- ☐ Zyglo Inspecting

Trip Policies Include Nonskeds, Court Rules

New York State Court of Appeals has ruled that present airline trip insurance contracts purchased from airport vending machines are valid for flights on nonscheduled as well as scheduled carriers.

In a significant test case, the court ordered the Fidelity & Casualty Co. to pay the beneficiary of a passenger killed in a nonscheduled plane crash the principal policy sum of $25,000 although the policy was limited to scheduled airline passengers.

The passenger purchased the policy from a vending machine at Newark Airport for a flight on Miami Airlines, Inc. The plane crashed at Elizabeth, N. J., shortly after takeoff on Dec. 16, 1951.

In a four-to-two ruling, the court held:

- Sign on the vending machine said "airline trip insurance." There was no differentiation between scheduled and nonscheduled.
- Although the policy specifically said the contract applied only to flights on civilian scheduled airlines, this was not spelled out clearly enough. Definition of the term "scheduled" seems to be too technical for the average layman.
- It was not established that a specimen policy was attached to the top of the machine for examination prior to purchase.
- The vending machine was located directly in front of the nonskeds' ticket counter at Newark.
- The words "civilian scheduled airline" were not too clear in the policy coverage clause because the statement "This policy is limited to aircraft accidents—read it carefully" was printed in bold lettering across the face of the document, partially covering this portion of the policy.

The dissenting judges held that the courts, as well as Congress and Civil Aeronautics Board, invariably have recognized that the scheduled airline is a definite, well-understood class of carrier.

"We do not see how the term 'scheduled' can mean 'nonscheduled,'" they stated, and according to law "an insurance company is as free as any other party to limit and condition its liability as it sees fit, so long as there is no statutory provision or rule of public policy to the contrary."

Godfrey Loses Pilot License for 6 Months

Civil Aeronautics Board has suspended Arthur Godfrey's pilot certificate for six months effective this week, ruling that the radio and TV star purposely made a careless takeoff from Teterboro, N. J., airport Jan. 7.

▶ **Findings**—The Board's three specific reasons for the suspension:

- Flying a Douglas DC-3 "in a manner that did not conform to the traffic pattern prescribed."
- Operating the plane "in such proximity to other aircraft so as to create a collision hazard."
- Flying without an up-to-date medical certificate.

Godfrey comments he has abided by government air regulations in 20 years of flying and will continue to do so. He says he will not appeal the decision. Civil Aeronautics Administration recommended a 30-day suspension.

BOAC Comets Resume Operations This Month

(McGraw-Hill World News)

London—British Overseas Airways Corp. will resume operation of Comet 1s on its London-Johannesburg run Mar. 23.

Modification of the airline's entire fleet of Comets, grounded since Jan. 11 as a result of the crash near Elba (AVIATION WEEK Jan. 18, p. 16), is nearing completion. All other Comet schedules are expected to be resumed shortly.

Decision to place the aircraft back

Our speciality is

LOFTING and 3-DIMENSIONAL MILLING

Our facilities are

24 PROFILERS
up to a 36" table

22 LARGE MILLERS
up to a #4 Cincinnati Miller and many other large tools and equipment.

☆ ☆ ☆

We welcome 3-dimensional prototype work. With a long background of engineering and manufacturing know-how on large prototype pieces and production, Bennel Machine offers you the services of a capable staff of aircraft and electro-mechanical engineers, an adequate plant capacity of 50,000 sq. ft. floor space and 15 years experience in the engineering and Manufacture of aircraft components. Prime contractors to the U. S. Signal Corps and the U. S. Navy Bureau of Ships. Currently we are supplying components to Republic Aviation Corp., Grumman Aircraft Engineering Corp., Kaiser Metal Products Inc., Sperry Gyroscope Co., Hazeltine Electronics Corp., Piasecki Helicopter Corp. and others. Currently we are manufacturing large 3-dimensional contour aircraft components to exacting specifications.

We invite your inquiry. Send for descriptive brochure.

BENNEL MACHINE COMPANY INC.

20 Grand Avenue Brooklyn 5, N. Y. ULster 5-4527-8-9

Proficiency and scheduled deliveries maintained.

AIRCRAFT
VALVES
BY
CIRCLE SEAL

Established Quality
Unexcelled Performance

CHECK VALVES—200 Series for low pressure or high pressure pneumatics. 800 Series for low pressure pneumatics or fuel.

SHUTTLE VALVES—400 Series for low pressure or high pressure pneumatics.

ALSO: *Breather valves, thermal relief valves, manual bleed valves.*

Where leakage is critical—
Specify Circle Seal and be sure!

CIRCLE SEAL *precision valves*
JAMES•POND•CLARK
2181 East Foothill Blvd., Pasadena 8, Calif.

AERO SUPPLIES CO.

WORLD'S LARGEST BENDIX SCINTILLA MAGNETO PARTS INVENTORY—
ALSO BOSCH MAGNETO PARTS.
Specializing in Parts for Following Magnetos—

Type	Part Number
WL-7	10-13810-2
VMN7DF	10-20273-1-4
VMN7DF-5	10-21819-2
SF7RN-1	10-13900-12
SB9RN	2-953-3
SF9RN	2-996-3
SF9LN-2	10-12453-5-6
SF9LN-4	10-20700-1
SF14LN-3	10-15364-19-20-21
SF14LN-4	10-9700-25
SF14RN-8	10-19125-10
SF14RN-8	10-27625-4
SF14LN-8	10-28250-3
DFN	10-8038-23
DFLN-6	10-25225-1-2-9
DF1SRN	10-21400-7-11
DF1SLN	10-33275-2
DF1SLN-1	10-30625-2

Send Inquiries for Eclipse—Jack & Heintz—Titeflex—and Stromberg.
We Supply From Our Own Stock.

AERO SUPPLIES CO.
514-516 HALSTEAD AVENUE
MAMARONECK, NEW YORK
Cable "AMNORCORP"
Tel. MAMARONECK 9-2611-2
Export Division
AMNOR AVIATION CORPORATION
Distributor
AEROQUIP CORPORATION
BENDIX PACIFIC DIVISION

in operation was announced by the British Minister of Transport A. T. Lennox-Boyd, after consultation with the Air Registration Board, Air Safety Board and BOAC.

▶ **No Public Inquiry**—Indications are that the decision was painfully difficult in view of the six Comet 1 crashes over the past 15 months. Cause has not been determined in the Elba crash, and to date there has been no public inquiry. Such an inquiry had been promised by Lennox-Boyd.

British officials state, however, that no weaknesses have been brought to light after minute technical investigation of remaining Comets.

More than 50 modifications have been or are being made, officials add, many designed to cope with theoretical causes of the Elba accident and the BOAC crash near Calcutta last May.

▶ **$1.5-Million Loss**—The decision to resume Comet service indicates that officials believe nothing further is likely to come from current salvage operations off Elba. It may take up to six months before the center section of the aircraft with engines is recovered from the sea.

With the two unexplained crashes, BOAC may be letting itself in for criticism by resuming Comet service, some observers here say, but feeling seems to be that further delay will not answer the baffling crash-cause questions.

Grounding already has cost BOAC almost $1.5 million.

French carriers also plan resumption of Comet service. Air France plans to put its three Comet 1s back in the air by mid-April, while Union Acromaritime de Transport (UAT) will start flying Paris-Johannesburg this week.

Four Airlines Get Adjusted Mail Rates

Civil Aeronautics Board has adjusted the mail rates of Braniff International Airways, Capital Airlines, Delta-C&S Air Lines and Western Air Lines, establishing a permanent rate of 45 cents per ton-mile retroactive to Jan. 1.

The new rate applies for the route segments of these carriers which are directly competitive with other carriers presently operating a final 45-cent rate.

▶ **Preventive Measure**—CAB says it took this action because of the announced policy of Post Office Department directed to the dispatching of mail over routes of airlines being paid the lowest compensation between any pair of cities. The Board says its action will prevent possible diversion of important mail revenues from Braniff, Capital, Delta and Western.

CAB also set a temporary rate of 53 cents per ton-mile over the remainder of the domestic systems of the four carriers, with provision that this temporary rate will be reviewed at a later date. It would be subject to retroactive adjustment, taking into account the effect of the 45-cent rate on competitive route segments.

Nonsked Proposes Scheduled Shuttle

An exemption to an exemption is asked by North American Airlines in its proposal before Civil Aeronautics Board to initiate shuttle aircoach service between New York and Washington.

The nonscheduled airline proposes to fly DC-4s between the two cities at a $10 one-way fare, $2.77 less than aircoach service now provided by Eastern Air Lines and American Airlines. Tickets would be sold aboard the aircraft without reservation. Carry-on baggage facilities would be provided.

▶ **Suitability Cited**—In order to approve such service, the Board would have to exempt the nonsked from its present exemption (regulations of the Civil Acronautics Act permitting operation of nonscheduled service) so it could begin scheduled flights.

The idea for such service was broached last summer by a member of the Board in the belief that an airline such as North American was peculiarly suited for that type service.

▶ **14-Flight Limit**—Last week the airline also filed a request for reconsideration of its earlier proposal (AVIATION WEEK Mar. 1, p. 64) to dismiss the enforcement proceeding currently under way by the Board.

The company asks that the proposal of two dissenters to CAB's earlier rejection be adopted. This would limit the airline to 14 flights per month between any two terminals as suggested by CAB members Josh Lee and Joseph Adams in their dissent.

The company also asked for postponement of the enforcement hearing scheduled to begin last week in Los Angeles.

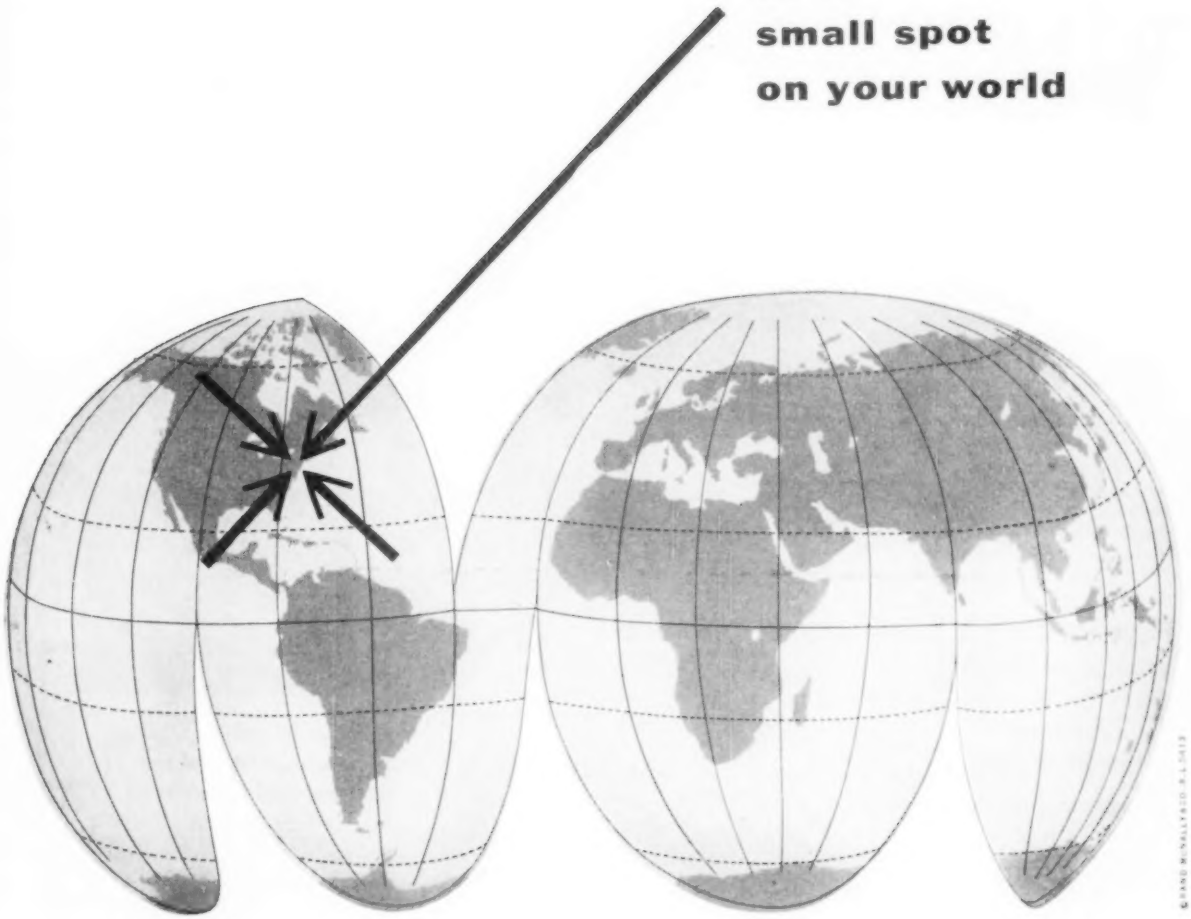
ODM Sets Fast Tax Writeoff for New Labs

New research and development laboratory facilities are eligible for fast tax amortization benefits under a ruling by the Office of Defense Mobilization.

The facilities must be used in development of products for which mobilization expansion goals have been set. These include aircraft, aluminum, titanium, cobalt, antimony, copper, molybdenum, nickel.

ODM says the ruling "is designed to recognize further the important place of scientific and technical research in defense mobilization."

something big is happening at a small spot on your world



It commenced less than eight years ago, when a team of top scientists and engineers gave the final nod to one of the most significant development programs in the recent history of our industry.

The place: Baltimore, Maryland.

The event: Inauguration of a completely new technology for the design and production of weapons systems—known as Martin Systems Engineering.

This is a science and a method of developing aircraft, guided missiles and electronic weapons not as today's flying vehicles but as coordinated and controlled space-borne systems of tomorrow.

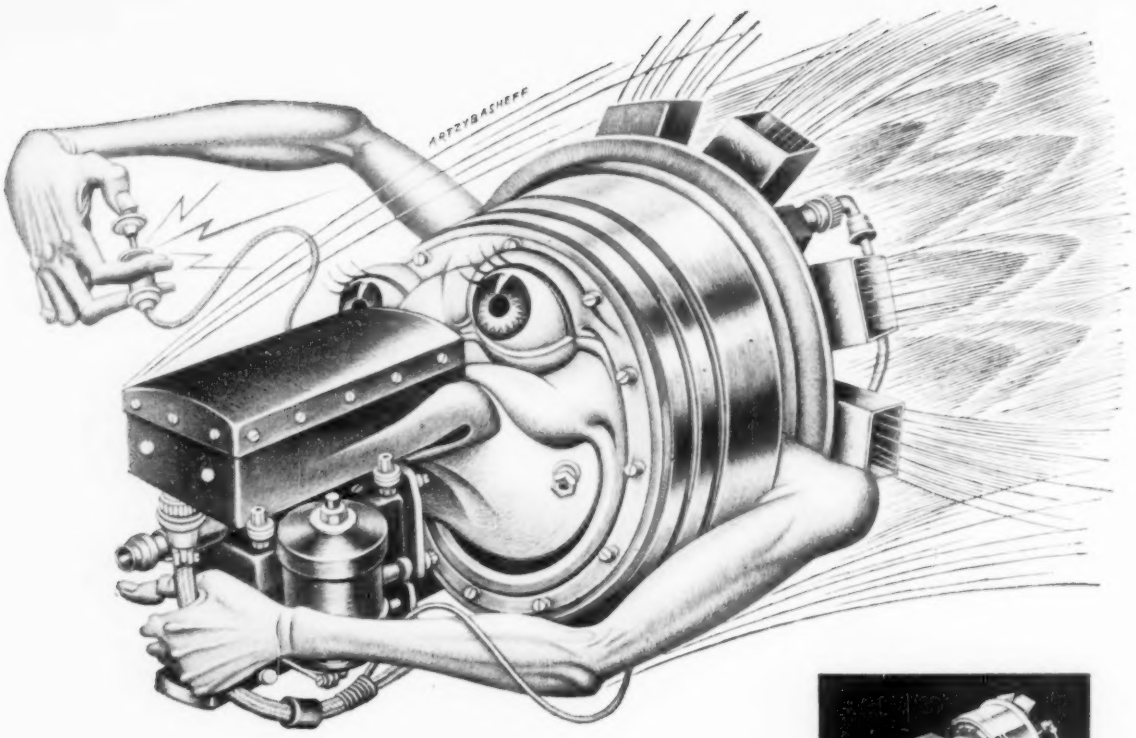
Most of the Martin story is in the top security classification, but part of it is this:

The complete integration of the major branches of aeronautical science through Systems Engineering now makes possible airpower that is being tailored to previously undreamed-of specifications.

You will hear more about Martin!

Martin AIRCRAFT

THE GLENN L. MARTIN COMPANY
BALTIMORE • MARYLAND



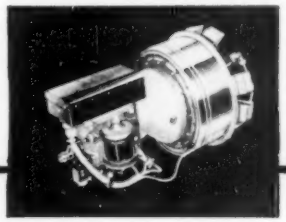
Parts that put new "starts" in jets

Good news for new-born jets! This typewriter-size Bendix Aviation self-starter is *built-in* . . . develops 340 horsepower in just 3½ seconds . . . enables a jet's main engine turbine to reach take-off speed in a matter of seconds after the pilot hits the starter. No more precious minutes lost while ground crews bring up mobile auxiliary starting power!

For 14 of the rugged, dependable, precision-machined parts that make up this self-starter for jets . . . Eclipse-Pioneer Division of BENDIX AVIATION CORPORATION looks to Lycoming.

Do *you* need precision parts . . . or any other of the diversified services listed with our signature? Lycoming's wealth of creative engineering ability . . . 2½ million square feet of floor space . . . and 6,000-plus machine tools stand ready to serve you. *Whatever* your problem . . . *look to Lycoming!*

Just off the press! "THE LYCOMING STORY" . . . 40 interesting, illustrated pages showing many ways Lycoming is ready to help you. Write for it on your letterhead.



For 14 major components of the first mass-produced self-contained starter ever built into large jets, Bendix Aviation looks to Lycoming for precision production.

Aircraft Engines
Industrial and Tank Engines
Engine Overhaul
Generating Units

Turbine Engineering and Research
Engineering Design and Development
Hardened and Ground Precision Parts
Gears and Machine Parts

Complete Assemblies
Heat-Treating and Plating
Steel Fabrication
Castings
Boilers

FOR RESEARCH • FOR PRECISION PRODUCTION

LOOK TO **Lycoming**

DIVISION OF AVCO CORPORATION

STRATFORD, CONN.
Manufacturing plants in Stratford, Conn., and Williamsport, Pa

New NWA President To Face Internal Fight

The resignation of Harold R. Harris as president and chief executive of Northwest Orient Airlines raises the question of a likely successor, who immediately will be faced with the problem of resolving the serious internal problems in the company resulting from differences of opinion among both stockholders and management.

There are reported to be two strong groups of Northwest stockholders in New York and another in Twin Cities, each having different ideas on how the airline should be run. Only unanimity evidenced by these groups in recent months was agreement to replace Harris.

▶ **Bad Spot**—In order to put any kind of progressive management program into operation, Harris' successor must first resolve these differences, gain the confidence of both the board and stockholders.

One observer summed up the situation thus: "Northwest is in a bad spot, and unless the next president is given a free hand, with little or no interference from non-management people having limited knowledge of airline operations, drastic consequences will result."

Indications are that Malcolm Mackay may get the nod to replace Harris. This feeling is strengthened by the fact the board returned Mackay to the executive vice president post which he held prior to Harris' reorganization of the company. Added significance is attached to the fact that Mackay made the announcement of Harris' resignation, while board chairman Croil Hunter had no comment.

▶ **Harris' View**—In tendering his resignation, Harris stated that "basic and irreconcilable differences of opinion have developed between myself . . . and a group who presently constitute a majority of the company's board of directors.

"These disagreements, involving the reversal of policies previously approved by the board, relate to basic policy underlying the planning for the company's future so that the company may properly discharge its obligations to the public, provide security and expand opportunity to its employes and offer a fair return to its owners."

Harris says his basic policies and program, reversed by the board, included:

• **Internal reorganization** of the company to define and separate executive and administrative duties in order to free top management from administrative details. This involved moving of Northwest's executive offices to New York from Twin Cities (AVIATION WEEK Nov. 2, 1953, p. 74).

• **Establishing credit** and financial standing to insure the company's survival. Harris pointed out that during the year he actively headed the company, net operating income was $1,277,000 after payment of federal income taxes of $1,501,000. This compares with a net operating income of $693,000 in 1952 after payment of $813,000 in taxes.

Net operating income available for common stock was $1.03 per share in 1953 after payment of $434,000 for preferred dividends, as compared with 31

Short Bros. Produces Canberra Jet Bombers

Silver-painted Canberra twin-jet bombers built by Short Bros., Belfast, Northern Ireland, await delivery to RAF Bomber Command. The super-priority Canberra bomber is being built by four different aircraft firms under subcontract. USAF version, the B-57A, is being built by Glenn L. Martin using Wright J65 Sapphire jets.

Engineers

AERO and MECHANICAL

Decidedly different opportunities with a unique development group

If you're stimulated by an out-of-the-ordinary challenge to your creative abilities, investigate a career with All American Engineering – an established, progressive organization that offers the aviation industry a complete service from creative idea to fabricated prototype. If working for a small, fast-moving organization sounds interesting – then you may belong on one of our engineering teams.

Research and Design Engineering
•
Development and Prototype Construction
•
Field and In-Flight Testing

Like to know more about All American Engineering and its increasingly important role in the aviation industry? Then write for free booklet – "A Complete Engineering and Development Service". After you read this manual, you'll know that being on the All American Engineering team is the *real* start of a successful career.

AAE

All American Engineering Company

DU PONT AIRPORT, WILMINGTON, DELAWARE

cents per share after payment of $440,000 for preferred dividends in 1952.

• **A program for acquiring** long-range equipment for the future in order that Northwest might remain competitive. Reports indicate that the company will not follow through on its order for five Lockheed Super Constellations.

• **Pressing for route renewals** and improvements "necessary for the future welfare of the company and its survival as a major trunkline. . . ."

• **Acquiring immediately** a small number of additional pressurized four-engine aircraft.

• **Instituting long-range** economic and financial planning.

• **Establishing new maintenance facilities** at Twin Cities.

Willis Player, vice president for public relations and H. Don Reynolds, executive assistant to the president resigned with Harris.

Both officials had been appointed by Harris subsequent to his taking office in January 1953.

American Realigns Administrative Setup

American Airlines is reorganizing into four major administrative units under a new plan aimed at decentralizing authority in New York and increasing responsibilities of officers in the field.

The plan calls for regrouping interrelated departments into one unit under a senior vice president and realigning the duties of officials for better coordination.

New senior vice presidents in charge of the four units: C. R. Speers, sales; O. M. Mosier, operations; W. J. Hogan, finance and planning; and C. W. Jacob, secretary.

▶ **"Simple Form"**—American president C. R. Smith says the realignment plan—drawn up by McKinsey & Co., New York management consultants—provides for a "simple form of organization and one well adapted to the requirements of our business."

The departments are scheduled to be regrouped this month into the following structure:

• **Operations.** Biggest change is setting up a new customer relations department in this unit to handle passenger and cargo services under the direction of vice president R.E.S. Deichler. "This will be a staff department which will establish the policy and standards by which American Airlines will provide services to its customers," Smith says.

Other departments under operations and the vice presidents in charge: equipment development, M. G. Beard; maintenance and engineering, Marvin Whitlock; purchasing and stores, G. J. Brandewiede; and flight, L. G. Fritz (AVIATION WEEK Mar. 1, p. 11).

• **Sales.** With the transfer of such functions as ticket and reservations offices to customer service, this unit will be able to concentrate on production of additional revenue and increased sales through "more rather than less emphasis on a well-planned, hard-hitting sales program," Smith says.

Reporting to sales will be the public relations department under vice president Rex Smith.

• **Finance and Planning.** This unit has taken on the additional responsibility of organizational planning, established the office of vice president L. E. Glasgow to handle all accounting and control and separated these duties from those of treasurer P. G. Larie.

• **Corporate Affairs.** Senior vice president Jacobs has assumed duties as secretary and director of this unit, which includes the properties and community department under vice president Walter H. Johnson and the Washington office under vice president Carlene Roberts.

Separate departments are research, under vice president William Littlewood, who will report directly to Smith, and personnel, directed by vice president G. K. Griffin.

KOHLER
PRECISION CONTROLS
Aircraft · Industrial · Automotive

The North American's Sabre-jet, formidable fighter plane in the nation's defense system, has in its equipment Kohler Precision Controls. Kohler Co. is a leading supplier to manufacturers of jet engines, commercial, military and private aircraft.

Facilities for aluminum forging and casting, machining, anodizing, assembling, testing and packaging are maintained in one Kohler plant—with an experienced, precision-skilled organization.

Our engineers develop valves, fittings and kindred controls to specification for volume production. Call on us for your next requirements. Write for booklet.

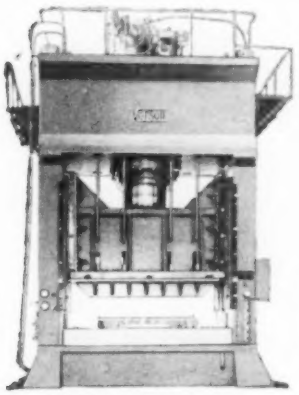
Kohler Co., Kohler, Wisconsin. Established 1873

KOHLER OF KOHLER

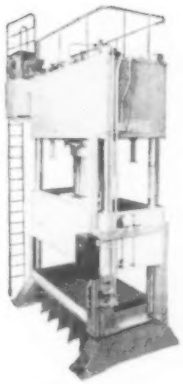
PLUMBING FIXTURES • HEATING EQUIPMENT • ELECTRIC PLANTS • AIR-COOLED ENGINES • PRECISION CONTROLS

FROM TRADE Verson MARK

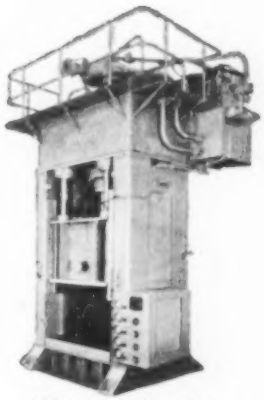
A COMPLETE RANGE OF HYDRAULIC PRESSES



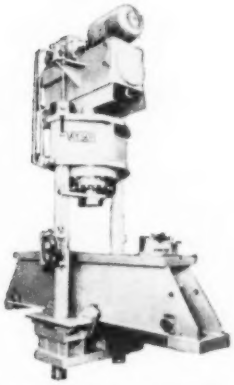
1200 ton straight side



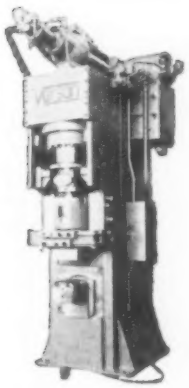
750 ton post type



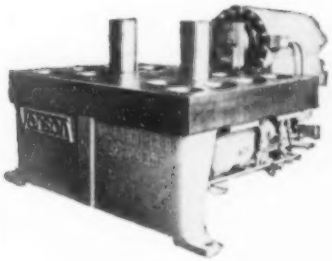
400 ton double action



400 ton straightening press



300 ton horn press



200 ton bending press

Write for your copy of the new Verson Hydraulic Press Catalog which contains detailed data on the entire Verson hydraulic line.

In the Verson line of hydraulic presses, there is a size and type to meet virtually every need from 75 tons up. In addition to the more common types illustrated above, Verson also manufactures such special models as gap type presses, bulldozers, hobbing presses, rubber pad cutting presses and pipe forming presses. If there is a question as to whether a mechanical type or a hydraulic type is best for your job, Verson, as a leading manufacturer of both types, is able to make unbiased recommendations.

Whatever your press problem, bring it to Verson and take advantage of our extensive know-how and experience.

A Verson Press for every job from 60 tons up.

TRADE Verson MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9311 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • SO. LAMAR AT LEDBETTER DRIVE, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

AERO-

DYNAMICISTS

for Lockheed's expanding Missile Systems Division

- Recently formed from other Lockheed Engineering organizations to prepare for the era of automatic flight, the Missile Systems Division deals exclusively with missiles and their component systems.
- Its expansion is creating "ground-floor" openings for Aerodynamicists experienced in any or all of the following fields:

  super-sonic aerodynamics
  stability, control,
  or performance analysis
  dynamics of free bodies

- In addition to outstanding career opportunities, the Lockheed Missile Systems Division offers you high salaries, commensurate with your experience, generous travel and moving allowances, and a better life for you and your family in Southern California.

Address inquiries to L. R. Osgood, Dept. AW-M-3-3A, Lockheed Missile Systems Division, 7701 Woodley Avenue, Van Nuys, California

LOCKHEED
MISSILE SYSTEMS
DIVISION
VAN NUYS, CALIFORNIA

EDITORIAL INDEX

A

AEROCAR

Factory data, p. 316.
Plane specifications, p. 198.

AERO DESIGN & ENGINEERING CORP.

Factory data, p. 316.
Plane specifications, p. 198.

AIRCOOLED MOTORS

Piston engine specifications, p. 216.

ALLEGHENY AIRLINES

1953 scheduled operations data, p. 163.

ALLISON DIV.—GENERAL MOTORS CORP.

Jet engine specifications, p. 220.

AMERICAN AIRLINES

1953 aircoach operations data, p. 166.
1953 scheduled operations data, p. 163.

AMERICAN HELICOPTER CORP.

Helicopter specifications, p. 205.

ANDERSON, GREENWOOD & CO.

Plane specifications, p. 198.
Plant data, backlog and 1953 sales, p. 316.

AIR TRANSPORT

Aircoach, growth, by cities, 1948-1953, p. 170.
Aircoach, scheduled operations and revenue data, p. 166.
Air transport records biggest year, p. 160.
Boeing 707, p. 166.
Coach service on upswing, p. 160.
Civil and military plane specifications, table, p. 200.
Comet certification, p. 166.
Comparative transport costs, direct operating cost per U.S. domestic plane-mile, p. 166.
Helicopter services, p. 164.
International services, p. 164.
Jet transports, p. 166.
Lift capacity gains, p. 161.
Long-range outlook, p. 169.
Nonsked picture, p. 162.
Outlook for 1954, p. 166.
Safety record good, p. 162.
Scheduled airfreight ton-miles, p. 182.
Scheduled operations, revenue data, and equipment, p. 163.
Subsidy trends, p. 165.
Traffic gain forecast, p. 160.
Trunkline mail revenue expected to gain, p. 161.
U.S. aircraft transport plane recapitulation by type and by service, p. 169.
World air traffic gains, 1937-1953, p. 164.

AUSTRALIA

Airlines prepare for reorganization, p. 304.
Military aircraft specifications, p. 208.
Military transport planes needed, p. 299.
Naval aviation develops slowly, p. 303.
Pilotless aircraft, p. 300.
RAAF budget small, p. 299.
Rocket-powered interceptor, p. 300.
Sabre will be fighter backbone, p. 299.
Scheduled domestic airline services, p. 299.
Scheduled international airline services, p. 299.
Turbine engine specifications, p. 222.
Woomera test range activities expanded, p. 307.

AVIONICS

Automatic data handling equipment needed, p. 131.
Automation techniques for mass production, p. 120.
Brighter picture for airline weather radar, p. 127.
CAA sits tight with DME, p. 126.
Ceramic modules, p. 122.
Civil-military DME at impasse, p. 126.
Closed-loop systems, p. 112.
Digital communications, p. 112.
Digital computers' new role, p. 112.
Flight-progress strip for tracking planes, p. 131.
High-power transistors, p. 119.
Human engineering to improve ARTC center design, p. 132.
Industry interest in automatic production, p. 122.
Microtronics, p. 115.
Military's problem in setting up Tacan system, p. 126.
"New" ANDB may be key to progress, p. 125.
New techniques buttress avionics role, p. 111.
New traffic control aids to get workout at Indianapolis, p. 132.
Project Tinkertoy (modular design of electronics), p. 120.
Project Volscan is super system forerunner, p. 112.
Radar traffic control, p. 129.
Selcal system for talking to pilots, p. 128.
Silicon diodes, p. 120.
Speech synthesis for transmitting oral commands, p. 114.
Super systems readied for military aviation, p. 114.
"Surface barrier" technique for transistor production, p. 118.
Surveillance radar use expanded at air terminals, p. 130.
Systems under development, p. 111.
Tacan's civil advantage, p. 126.
Transistor photocell, p. 120.
X-band radar, p. 129.

B

BAUMANN AIRCRAFT CORP.

Plane specifications, p. 198.
Plant data, backlog and 1953 sales, p. 316.

BEECH AIRCRAFT CORP.

Business plane specifications, p. 198.
Military plane specifications, p. 196.
Plant data, backlog and 1953 sales, p. 316.

BELL AIRCRAFT CORP.

Helicopter specifications, p. 205.
Plant data, backlog and 1953 sales, p. 316.
Research aircraft specifications, p. 195.

BELLANCA AIRCRAFT CORP.

Business plane specifications, p. 198.

BOEING AIRPLANE CO.

Military aircraft specifications, p. 196.
Plant data, backlog and 1953 sales, p. 316.
Transport plane specifications, p. 200.

BONANZA AIRLINES

Aircoach operations data, p. 166.
Scheduled operations data, p. 163.

BRANIFF AIRWAYS

Aircoach operations data, p. 166.
Scheduled operations data, p. 163.

BUSINESS FLYING

Basic information needed, p. 137.
Basic problems to be solved, p. 136.
Business plane specifications, p. 198.
Lack of adequate equipment, p. 136.
Market tempting, p. 138.
Multi-million market goes begging, p. 136.
"Old standbys" make up majority of twin-engine fleet, p. 140.
Photos of business planes, Beech D18S, Piper, Apache, p. 136; Cessna 310, Aero Commander, p. 137; Temco Twin-Navion, Beech Twin-Bonanza, p. 138.
Single-engine equipment, p. 140.
Statistics are scarce or late, p. 140.
Statistics for 1952, hours flown, miles flown, total aircraft, p. 141.
Twin-engine equipment, p. 138.

C

CALLAIR

Plane specifications, p. 198.

CANADA

Aircraft industry set new record, p. 264.
Airlines getting new planes, p. 271.
Airlines report good year in 1953, p. 271.
Canadian Pacific Airlines, p. 271.
Civil and military plane specifications, p. 208.

DYNAMICISTS

for Lockheed's expanding Missile Systems Division

- Recently formed from other Lockheed Engineering organizations to prepare for the era of automatic flight, the Missile Systems Division deals exclusively with missiles and their component systems.
- Its expansion is creating "ground-floor" openings for Dynamicists whose experience in dynamics of flight covers any or all of the following fields: flutter and vibration, trajectory analysis, dynamic stability and related fields.
- In addition to outstanding career opportunities, the Lockheed Missile Systems Division offers you high salaries, commensurate with your experience, generous travel and moving allowances, and a better life for you and your family in Southern California.

Address inquiries to L. R. Osgood, Dept. AW-M-3-3D, Lockheed Missile Systems Division, 7701 Woodley Ave., Van Nuys, California

LOCKHEED
MISSILE SYSTEMS DIVISION
VAN NUYS, CALIFORNIA

Contribution to NATO, p. 262.
Major aviation plants, p. 266.
New planes in production, p. 264.
New RCAF bases built, p. 262.
Production lineup, p. 266.
Radar warning net, p. 262.
Trans-Canada Air Lines, p. 271.
Turbine engine specifications, p. 222.

CAPITAL AIRLINES
Aircoach operations data, p. 166.
Scheduled operations data, p. 163.

CARIBBEAN ATLANTIC AIRLINES
Scheduled operations data, p. 163.

CENTRAL AIRLINES
Scheduled operations data, p. 163.

CENTRAL LAMSON CORP.
Plant data, p. 316.

CESSNA AIRCRAFT CO.
Business plane specifications, p. 198.
Helicopter plans, p. 144.
Military plane specifications, p. 196.
Plant data, backlog and 1953 sales, p. 316.

COLONIAL AIRLINES
Aircoach operations data, p. 166.
Scheduled operations data, p. 163.

CONSOLIDATED VULTEE AIRCRAFT CORP.
Military plane specifications, p. 196.
Plant data, backlog and 1953 sales, p. 316.
Research plane specifications, p. 195.
Transport plane specifications, p. 200.

CONTINENTAL AIR LINES
Scheduled operations data, p. 163.

CONTINENTAL MOTORS
Piston-engine specifications, p. 216.

CONVERTAWINGS
Helicopter specifications, p. 205.

CURTISS-WRIGHT CORP.
Jet engine specifications, p. 220.
Plant data, backlog and 1953 sales, p. 316.
Reciprocating engine specifications, p. 216.

D

DELTA AIR LINES
Aircoach operations data, p. 166.
Scheduled operations data, p. 163.

DOMAN HELICOPTERS, INC.
Helicopter specifications, p. 205.
Plant data, backlog, p. 316.

DOUGLAS AIRCRAFT CO., INC.
Military plane specifications, p. 196.
Plant data, backlog and 1953 sales, p. 316.
Research plane specifications, p. 195.
Transport plane specifications, p. 200.

E

EASTERN AIR LINES
Aircoach operations data, p. 166.
Scheduled operations data, p. 163.

ENGINEERING
Altitude marks set by military and research planes, p. 188.
Ames Aeronautical Laboratory, p. 190.
Engine studies figure high at NACA, p. 188.
Highspeed flights mark turning point, p. 187.
Integration of aircraft and avionics is big trend at NACA, p. 187.
Langley Aeronautical Laboratory, p. 190.
Lateral stability a big problem, p. 187.
Lewis Flight Propulsion Laboratory, p. 190.
Military airplane speed records, p. 187.
Noise studied by NACA, p. 188.
Photos of U. S. research planes, p. 195.

COMPACT DEPENDABLE EFFICIENT *Rotary Power* **by Carter**

THE NEW *Custom*

DC-AC CONVERTER

These latest of all Carter DC to AC Converters are specially engineered for professional and commercial applications requiring a high capacity source of 60 cycle AC from a DC power supply. Operates from storage batteries, or from DC line voltage. Three "Custom" models, delivering 300, 400, or 500 watts 115 or 220 V. AC. Wide range of input voltage, 12, 24, 32, 64, 110 or 230 V. DC. Unequalled capacity for operating professional recording, sound movie equipment and large screen TV receivers. Available with or without manual frequency control feature.

MAIL COUPON FOR CATALOG

Carter Rotary Power Supplies are made in a wide variety of types and capacities for communications, laboratory and industrial applications. Used in aircraft, marine, and mobile radio, geophysical instruments, ignition, timing, etc. MAIL COUPON NOW for complete Dynamotor and Converter Catalogs, with specifications and performance charts on the complete line.

Carter MOTOR CO.
2640 N. Maplewood Ave.
Chicago 47

Carter Motor Co.
2640 N. Maplewood Ave., Chicago 47

Please send new catalogs containing complete information on Carter "Custom" Converters and other Rotary Power Supplies.

Name_____

Address_____

City_____ State_____

DEFENSE PRODUCTS *of High Quality at Low Cost* DELIVERED ON TIME

A modern cold room at AC where functional tests on equipment are made under controlled conditions.

GM
GENERAL MOTORS
GM
GOOD MANAGEMENT

AC KNOW HOW

Giving Defense Products the "Third Degree!"

In the AC plants will be found not only the latest machine-tool equipment of every description, but also the very newest and finest in testing facilities –

- **complete testing laboratories**
- **electronic computing brain**
- **high-altitude test chambers**
- **vibration-testing equipment**
- **sound rooms**
- **cold rooms – to 100° below zero F**
- **high-temperature rooms**
- **humidity chambers**
- **darkrooms**
- **screened rooms for elimination of outside electrical interference**
- **standards rooms for maintaining basic standards for electrical test equipment**

Years of experience in producing complex electro-mechanical devices for the Armed Forces makes AC a logical choice to engineer, develop and build any new devices of a similar nature which may be under consideration by your organization.

AC is now producing – in volume – these complex, high-precision, electro-mechanical devices for the Armed Forces:

- **"A" Series Gun-Bomb-Rocket Sights**
- **A-1A Bombing Navigational Computers**
- **T-38 Fire Control System for the Skysweeper**

★

Would you like employment offering travel and educational opportunities? We invite graduate electronic, mechanical, servo and field service engineers to write our Salary Personnel Department for booklet "You and Your Future."

AC SPARK PLUG DIVISION GM GENERAL MOTORS CORPORATION
FLINT, MICHIGAN

■ EDITORIAL INDEX

Research aircraft speed marks, p. 187.
Research subcontracts by NACA, p. 192.
Unitary plan to coordinate tunnel procurement, p. 192.
U. S. research plane specifications, p. 195.

F

FAIRCHILD ENGINE & AIRCRAFT CORP.

Transport plane specifications, p. 200.

FREDERIC FLADER, INC.

Plant data, backlog and 1953 sales, p. 316.

FLETCHER AVIATION CORP.

Military aircraft specifications, p. 196.
Plant data, backlog and 1953 sales, p. 316.

FLYING TIGER LINE

Operations data, p. 163.

FRANCE

Air Ministry budget for 1954, p. 256.
Aircraft manufacturing facilities, p. 254.
Aircraft plants closing, p. 260.
Airline purchases may pick up, p. 256.
Civil and military aircraft specifications, pp. 210-212.
French air force composition, p. 256.
Helicopter specifications, p. 214.
New military planes being tested, p. 258.
Principal planes being produced, p. 256.
Turbine engine specifications, p. 222.

FRONTIER AIRLINES

Scheduled operations data, p. 163.

G

GAS TURBINE ENGINES

Foreign specifications, p. 222.
U. S. specifications, p. 220.

GERMANY

Air force plans well advanced, p. 284.
Airline makeup, p. 283.
Airline fleet plans, p. 283.
Gliding, p. 288.
Industry leaders feel they are slipping behind, p. 288.
New airline awaits EDC ratification, p. 280.
Training program, p. 284.

GOODYEAR AIRCRAFT CORP.

Plant data, p. 316.

GREAT BRITAIN

Aviation exports, 1946-1953, value, box, p. 232.
Boundary-layer control, p. 236.
Bristol Britannia progress, p. 246.
Civil aircraft built for home and export since World War II, p. 230.
Civil transport orders, p. 240.
DC-3 replacements, p. 248.
DH Comet problems, p. 242.
Engines not short, p. 232.
Employment in aircraft industry, p. 240.
Helicopters, p. 250.
Helicopter specifications, p. 214.
Intruder fighters, p. 235.
Jet transports ordered to date, p. 234.
Lightweight fighter, p. 239.
Military aircraft exports on order or delivered—1953, p. 246.
Missile developments cloaked, p. 235.
Naval aviation's new fighters, p. 252.
New jet transports, p. 246.
Offshore procurement, p. 228.
Private funds for research, p. 236.
Research, p. 232.
Research suffers, p. 227.
Reverse-thrust device, p. 244.
Specifications of military and civil planes, pp. 208-210.
Troop commitments overseas, p. 227.
Turbine engine specifications, p. 222.
Turboprop thinking, p. 248.
United Kingdom aero exports since World War II, p. 230.
U. S. aid, p. 228.
Vickers Viscount, p. 240.
Vickers 1000, p. 247.

GRUMMAN AIRCRAFT ENGINEERING CORP.

Military aircraft specifications, p. 196.
Plant data, p. 316.

GUIDED MISSILES

Aerojet Aerobee, p. 86.
Air-to-air missiles, p. 79.
Air-to-surface missiles, p. 80.
Air-to-underwater, p. 80.
Ballistic missile under close scrutiny, p. 84.
Bell B-63 Rascal, p. 80.
Bell Meteor, p. 79.
Bendix Loki, p. 84.
Boeing F-99 Bomarc, p. 82.
Chrysler Redstone, p. 85.
Convair Terrier, p. 82.
Douglas Bumper, p. 86.
Douglas Honest John, p. 85.
Douglas Nike, p. 82; photo, p. 78.
Fairchild Lark, p. 82.
Fairchild Petrel, p. 82.
Firestone Corporal, p. 85.
Gardner committee studies missile industry, p. 79.
General Electric Hermes A-1, p. 86; photo, p. 78.
General Electric Hermes A-3, p. 86.
Grumman Rigel, p. 86.
Hughes F-98 Falcon, p. 79.
Lacrosse short-range missile for Marines, p. 86.
Lockheed X-7, p. 86.
Martin B-61 Matador, p. 85.
Martin Oriole, p. 79.
Martin Viking, p. 86.
North American Navaho, p. 85.
North American X-10, p. 85, 86.
Northrop B-62 Snark, p. 85.
Oerlikon MX1868, p. 84.
Sperry Sparrow, p. 79.
Surface-to-air, p. 82.
Surface-to-surface, p. 84.
Test or research vehicles, p. 86.
U. S. guided missiles specifications, p. 80.
Vought Regulus, p. 85.

GYRODYNE CO. OF AMERICA

Helicopter specifications, p. 205.
Plant data, backlog and 1953 sales, p. 316.

BOURNS
sub-miniature
TRIMPOTS
TRADE MARK

PROVIDE THE ULTIMATE IN CIRCUIT TRIMMING

Simple screwdriver adjustment . . .

The TRIMPOT is a 25 turn, fully adjustable wire-wound potentiometer, designed and manufactured exclusively by BOURNS Laboratories. Electrical settings in increments of ¼ to ½% are securely maintained during vibration of 20 G's up to 2,000 cps or sustained acceleration of 100 G's. BOURNS' unique self-locking design eliminates cumbersome locknuts. Power rating is ¼ watt at 100° F. Standard resistance values from 250 ohms to 25,000 ohms are available for immediate delivery. Information on higher and lower resistances on request.

BOURNS TRIMPOTS are accepted as standard components by aircraft and missile manufacturers and major industrial corporations.

9 TRIMPOTS TAKE LESS SPACE THAN A 2¢ STAMP

Tiny cross-sectional size—only 1/4" x 5/16"—and rectangular shape save valuable panel space. Instruments are easy to mount individually or in stacked assemblies with two standard screws through the body eyelets.

Bourns also manufactures precision potentiometers to measure Linear Motion; Gage, Absolute, and Differential Pressure and Acceleration.

BOURNS LABORATORIES
6135 MAGNOLIA AVENUE
RIVERSIDE, CALIFORNIA
Technical Bulletin On Request, Dept. 52

© B L PATENTS PENDING

■ EDITORIAL INDEX

H

HAWAIIAN AIRLINES
Scheduled operations data, p. 163.

HELICOPTER AIR SERVICE
Scheduled operations data, p. 163.

HELICOPTERS
All-weather operation, p. 147.
Bell models, p. 147.
Business uses, p. 144.
Capacity, p. 148.
Compound models, p. 147.
Convertiplanes, p. 152.
Current development status, p. 143.
Heliport planning, p. 147.
Military copter success spurs civil use, p. 142.
Military experience, p. 148.
Noise problems, p. 147.
One-man copters, p. 152.
Photos: Bell XHSL-1, p. 142; Doman YH-31, p. 144; Hiller YHJ-1, p. 145; Jacobs 104, Kaman; HOK-1, p. 144; Piasecki YH-16, p. 142; Piasecki H-21A, p. 148; Sikorsky H-19, p. 148; Sikorsky XHR2S-1, p. 142.
Piasecki developments, p. 145.
Range, p. 148.
Sikorsky types, p. 145.
Specifications of foreign helicopters, p. 214.
Specifications of U. S. copters, p. 205.
Transport speeds, p. 148.
Transport types, p. 144.

HELIO AIRCRAFT CORP.
Plane specifications, p. 198.

HILLER HELICOPTERS
Helicopter specifications, p. 205.

HUMAN FACTORS
Aero medical sciences, p. 154.
Man-machine teamwork is key to best use of weapons systems, p. 154.
Personnel and Training Research Center, organized by USAF, p. 158.

I

ITALY
Airlines close 1953 with a profit, p. 292.
Civil and military aircraft specifications, pp. 210-212.
Experimental jets get priority, p. 290.
Extra airline services expected, p. 292.
Fiat assembling 50 North American F-86Ks, p. 291.
Fiscal 1953-1954 budget smaller than previous year, p. 289.
Industry suffers, p. 290.
Offshore procurement spending $42 million, p. 291.

JACOBS AIRCRAFT ENGINE CO.
Factory data and 1953 sales, p. 316.
Helicopter specifications, p. 205.

J

JAPAN
Defense phases, p. 276.
Five-year air program goal, p. 278.
Fuji Heavy Industries Co. (Nakajima), p. 279.
Kawasaki Aircraft Co., p. 278.
Military aviation planning group created, p. 272.
Mitsubishi Heavy Industry Co., p. 278.
Nippon Jet Engine Co., p. 280.
Shin Meiwa Industry Co. (Kawanishi), p. 279.

K

KAMAN AIRCRAFT CORP.
Helicopter specifications, p. 205.
Plant data, backlog and 1953 sales, p. 316.

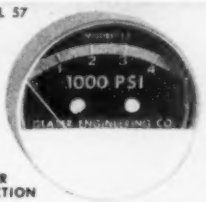
Save ⅔ of your Wire Twisting Costs with ROBINSON WIRE TWISTERS

Manufacturers, sub-assembly plants, airlines, military bases, research, and overhaul organizations all over the world are now safety wiring 3 engines, with the split-second whirling action of the Robinson Wire Twister, in the time required for one by any other method. Savings up to $140 per engine are enough to pay for 8 twisters. 3-tools-in-1: pliers, cutters, twister. 12" and 9" length. $19.50 ea.—$18.50 ea. in doz. FOB Sacramento. *Unconditionally guaranteed.* Write for details.

RALPH C. ROBINSON CO.
Box 494-422
North Sacramento 15, Calif.

Amazing
PRESSURE Glaser GAUGES

MODEL 57 ⅔ SIZE



REAR CONNECTION
WEIGHT 2 OZ.

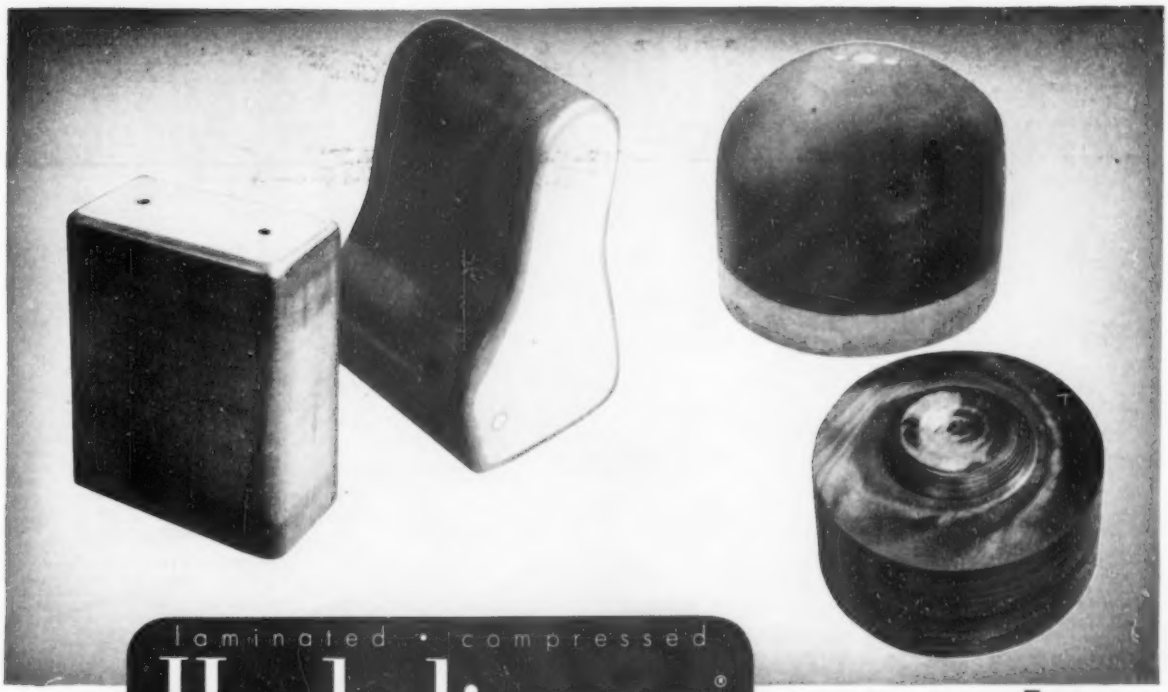
But True
SPECIFIED BY ARMED FORCES INDUSTRY & LABORATORIES
Because

- REVOLUTIONARY DESIGN
- NO GEARS, SPRINGS, LINKAGE OR BEARINGS
- POSITIVELY NO MAINTENANCE
- AROUND THE DIAL ACCURACY
- CORROSION RESISTANT-SEALED CASE
- WITHSTANDS 50G SHOCK TEST
- VIBRATION TESTED 8G—(20-500 VAR. FREQ.)
- SELF DAMPENING-NON EXPLOSIVE
- DIAL SIZES 1" DIA. & UP
- ALARM CONTACTS WHEN DESIRED

FOR COMPLETE INFORMATION WRITE, PHONE OR WIRE

Designers for Industry
A Glaser ENTERPRISE

4746 W. WASHINGTON BLVD.
LOS ANGELES 16, CALIFORNIA
Phone York 7101 Cable Address GLAENCO



laminated • compressed

Hy-du-lignum®... at work!

made-to-measure density

Here you see Hy-du-lignum in two of its many uses. The marform blocks or dies made of Hy-du-lignum are used on marform presses at North American Aviation to form parts out of aluminum alloy sheet stock.

For the spinning block illustrated, the material proved so easy to work that the tool was made by a spin lathe operator at North American Aviation's Columbus, Ohio, Division plant, instead of by a toolmaker.

Whatever your sheet metal tooling needs may be, for short or long run production, Hy-du-lignum is the die stock material you should use. It meets all requirements for large or small diameter.

what is Hy-du-lignum?

Hy-du-lignum is not impregnated, it is not a "compreg" . . . it is a laminated wood made of thin sheets of specially selected hardwood veneers, interleaved with a synthetic plastic resin sheet film, — compressed and heat-pressure-bonded to a compression value of 35,000 psi.

There are many uses for Hy-du-lignum

- Helicopter Blades
- Rubber Press Blocks
- Templates
- Spinning Blocks
- Hand Form Blocks
- Drill Jigs
- Checking Fixtures
- Stretch Form Tools
- Shop Aids
- Drill and Router Blocks
- Sub-Assembly, Spot Weld Fixtures, etc.
- Layout Boards
- Tube Bending
- Contour Rolls
- Form Rolls

- *Form dies for hand-lay-up or rubber bag molding reinforced (glass) plastics.*

Standard size boards 84" x 32" are available in thicknesses up to 3" in both High and Medium Densities; 82" x 31" over 3" and up to 4" thick in High Density; and 84" x 14" over 4" in thickness in High Density. Boards of non-standard size may be had in any thickness up to 8" in High Density, and up to 6" in Medium Density.

THE SEAL OF QUALITY AND SERVICE — US — SINCE 1857

Hy-du-lignum *division*

U S BOBBIN & SHUTTLE CO.

LAWRENCE, MASSACHUSETTS U. S. A.

COAST TO COAST

FASTEST NONSTOP AND ONE-STOP SERVICE

American is FASTER than any other Airline between NEW YORK and CALIFORNIA

On coast-to-coast trips, American's new DC-7 service gives you a definite advantage. Between New York and San Francisco, American offers two DC-7 flights daily, both faster than any other airline. Between New York and Los Angeles, American's two daily *nonstop* DC-7 flights are not only faster than any other airline, but the *only* nonstop transcontinental service in both directions. So, for coast-to-coast travel, *always call American first.*

America's Leading Airline **AMERICAN AIRLINES INC.**

■ EDITORIAL INDEX

L

LAKE CENTRAL AIRLINES
Scheduled operations data, p. 153.

LANIER AIRCRAFT CORP.
Plane specifications, p. 198.

LOCKHEED AIRCRAFT CORP.
Military plane specifications, p. 196.
Plant data, backlog and 1953 sales, p. 316.
Transport plane specifications, p. 200.

LYCOMING DIVISION, AVCO MFG. CORP.
Piston engine specifications, p. 216.
Plant data, p. 316.

M

MANUFACTURING
AIA recommends six-point aircraft production program, p. 109.
Aircraft industry plant data, backlog, sales, p. 316.
Abandonment of letters of intent, p. 106.
Aircraft delivery rate in thousands of planes, p. 102.
Airframe weight in millions of pounds, p. 102.
Average hourly earnings in the aircraft industry, by month, 1953, p. 108.
Average weekly hours in the aircraft industry, by month, 1953, p. 108.
Backlog of aircraft orders, p. 106.
Competition tougher, p. 108.
Conservative policy on progressive payments, p. 108.
Employment grows to 750,000 in 1953, p. 105.
"Feast or famine" problem, p. 109.
Labor turnover per 100 employes in the aircraft industry by month, 1953, p. 107.
Military market, p. 101.
More airframe weight, p. 101.
New doctrine aims to stabilize industry, p. 101.
Plans for financing about 5,500 planes yearly, p. 102.
Plant area increases to more than 128 million sq. ft. in 1953, p. 105.
Production and related worker employment in the aircraft industry, by month, 1953, p. 107.
Production climbs to 12,000 planes in 1953, p. 105.
Reduction of overtime, p. 108.
Republicans take new look at military plane production, p. 105.
Return to fixed-price and incentive target-type contracts, p. 106.
Shipments by plants of complete civilian aircraft and engines, p. 316.
Spending level stays high, p. 101.
Stretchout tailored to meet each firm's problems, p. 106.
Total employment in the aircraft industry, by month, 1953 p. 107.
What's ahead in military contracting, p. 102.

MARTIN, GLENN L., CO.
Military aircraft specifications, p. 196.
Plant data, p. 316.
Transport plane specifications, p. 200.

McCULLOCH MOTORS CORP.
Helicopter specifications, p. 205.

McDONNELL AIRCRAFT CORP.
Military plane specifications, p. 196.
Plant data, backlog and 1953 sales, p. 316.

MATS
Airplane equipment, p. 173.
Air rescue service, p. 178.
Airways and communications services, p. 174.
Air weather service, p. 174.
Atlantic Division, p. 172.
Continental Division, p. 172.
Ferrying and VIP service, p. 178.
Flight service, p. 178.
Operation set for peace or war, p. 172.
Pacific Division, p. 172.
Photos: Boeing KC-97G, p. 173; Chase C-123, p. 173; Douglas C-124, p. 173; Fairchild C-119, p. 172.
Requirements set by JCS, p. 173.
Routes, p. 172.
Technical support services, p. 174.

MEYERS AIRCRAFT CO.
Plane specifications, p. 198.
Plant data, backlog and 1953 sales, p. 316.

MILITARY AVIATION—U.S.
Aircraft appropriations and expenditures, 1935-1955, p. 220.
Aircraft specifications, p. 196.
New military and research planes, color portfolio: Boeing YB-52, Republic F-84F, Douglas XF4D-1, Boeing KB-47B and B-47B, McDonnell XF3H-1, Douglas XA3D-1, North American YF-100A, Douglas D-558-2, Vought Regulus, Douglas X-3, Bell X-1A and Convair XF2Y-1, pp. 40-43.

MOHAWK AIRLINES
Scheduled operations data, p. 163.

MOONEY AIRCRAFT, INC.
Plane specifications, p. 198.

N

NATO
Airpower is West's weakest link, p. 75.
All-weather fighters needed, p. 77.
Facilities buildup, p. 77.
Fuel storage buildup, p. 77.

NATIONAL AIRLINES
Aircoach operations data, p. 166.
Scheduled operations data, p. 163.

NETHERLANDS
Civil and military aircraft specifications, p. 212
Expansion of force, p. 307.
Fokker activities, p. 311.
KLM fleet, p. 311.
KLM traffic, p. 311.
Naval air service strengthened, p. 307.
Production lineup for 1954, p. 311.

NEW YORK AIRWAYS
Operations data, p. 163.

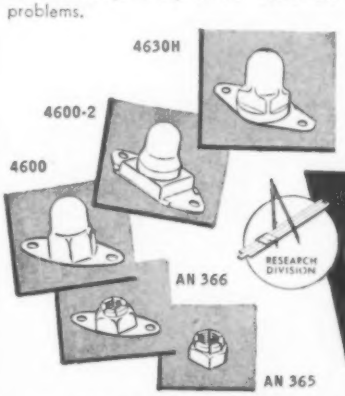
NORTH AMERICAN AVIATION, INC.
Military aircraft specifications, p. 196.
Plant data, backlog and 1953 sales, p. 316.

NORTH CENTRAL AIRLINES
Scheduled operations data, p. 163.

NORTHEAST AIRLINES
Scheduled operations data, p. 163.

fastening problems
Solved

The self-locking nuts used in sealing applications have evolved from the simple AN365 hex nut with sealing compound. Today, the highly specialized 4630H series, a completely self-contained sealing unit, has solved the problem of high pressure sealing. Each improvement in fastener design has been made possible by a thorough study of our customers' problems.



You can reduce your costs by using our ten years experience in the design and development of *specialized* fasteners. Consultation, especially in the *design* state, will result in a cheaper, more efficient fastener for your product.

Nutt-Shel
RESEARCH DIVISION

Manufacturers of self locking anchor nuts and bolt and nut retainers.

811 AIRWAY GLENDALE 1, CALIF.

■ EDITORIAL INDEX

NORTHROP AIRCRAFT, INC.
Plane specifications, p. 196.
Plant data, backlog and 1953 sales, p. 316.
Research plane specifications, p. 195.

NORTHWEST AIRLINES
Aircoach operations data, p. 166.
Scheduled operations data, p. 163.

O

OZARK AIR LINES
Scheduled operations data, p. 163.

P

PAN AMERICAN-GRACE AIRWAYS
Scheduled operations data, p. 163.

PIASECKI HELICOPTER CORP.
Helicopter specifications, p. 205.
Plant data, backlog and 1953 sales, p. 316.

PIEDMONT AVIATION
Scheduled operations data, p. 163.

PIONEER AIR LINES
Scheduled operations data, p. 163.

PRATT & WHITNEY DIVISION, UAC
Piston engine specifications, p. 216.

R

REPUBLIC AVIATION CORP.
Military plane specifications, p. 196.
Plant data, p. 316.

RIDDLE AIRLINES
Cargo operations data, p. 163.

RUSSIA
Aircraft specifications, p. 206.
All-weather aircraft, p. 92.
Estimate of military air fleet, p. 75.
Ground support planes, p. 92.
Helicopters, p. 93.
Light bombers, p. 93.
MiG-15 production, p. 91.
Naval aircraft, p. 93.
New military planes, p. 90.
New turboprop bombers, p. 90.
Photos and drawings: Tupolev-200, p. 90; Ilyushin-38, MiG-15, Tupolev-4, p. 91; MiG-17, Lavochkin-17-2, p. 93.
Strategic airpower undergoes buildup, p. 90.
Training problems, p. 93.

RYAN AERONAUTICAL CO.
Military plane specifications, p. 196.
Plant data, backlog and 1953 sales, p. 316.

SIKORSKY AIRCRAFT DIV., UAC
Helicopter specifications, p. 205.

SOUTHERN AIRWAYS
Scheduled operations data, p. 163.

SOUTHWEST AIRWAYS
Scheduled operations data, p. 163.

S

SPAIN
Airbases chosen for USAF, p. 294.
Air force to get U.S. planes, p. 294.
Aircraft industry active in development, p. 296.
Aviacion y Comercio expands, p. 296.
Civil aviation makes progress, p. 296.
Iberia Airlines adds to fleet, p. 296.

SWEDEN
Anti-aircraft equipment needed, p. 315.
Atomic weapons chances slim, p. 315.
Civil and military aircraft specifications, p. 212.
Day fighters comprise main defense, p. 315.
Defense budget, p. 312.
Production space being expanded, p. 315.

T

TAYLORCRAFT, INC.
Plane specifications, p. 198.
Plant data, backlog and 1953 sales, p. 316.

TEMCO AIRCRAFT CORP.
Military aircraft specifications, p. 196.
Military plane specifications, p. 196.
Plant data, p. 316.

TRANS-PACIFIC AIRLINES
Scheduled operations data, p. 163.

TRANS-TEXAS AIRWAYS
Operations data, p. 163.

TRANS-WORLD AIRLINES
Scheduled aircoach data, p. 166.
Scheduled operations data, p. 163.

U

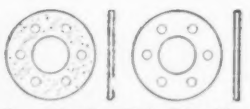
UNITED AIR LINES
Scheduled aircoach data, p. 166.
Scheduled operations data, p. 163.

Join the happy chorus

Welcraft guarantees material thickness accuracy to within .003 tolerance on any gasket material. Surface irregularities normally found in gasket materials are eliminated. Such smooth, close tolerances have never before been available. We can produce precision ground gaskets for you. Any size... any shape ...reasonable prices.

Send us your blueprints.
Don't delay — Write today.

This detailed comparison shows you the difference.



Conventional Gasket — Welcraft Precision Ground Gasket

WELCRAFT Products Co., Inc.
325 Michigan Street
New Carlisle, Indiana

at 9000 feet over Mexico City — on one engine

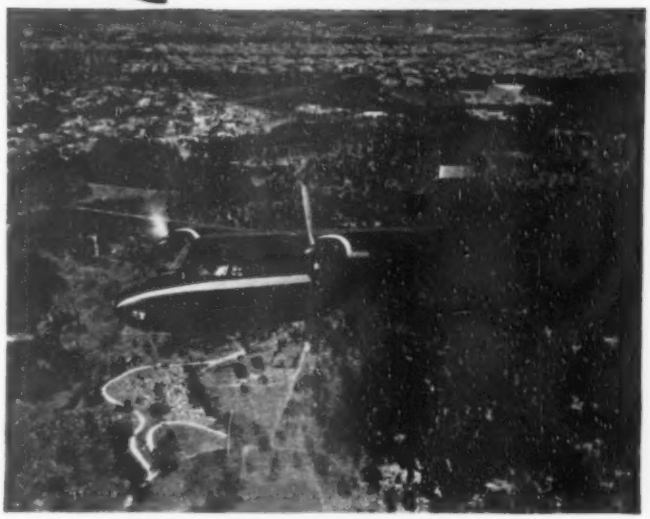
A HARTZELL Propeller Made it Possible

"The use of Hartzell full-feathering propellers is a prime factor in the Aero Commander's ability to meet this high standard of performance."

That was Aero's comment on the test, pictured at the right, in which an Aero Commander had no difficulty maintaining altitude with one propeller feathered while flying at 9000 feet over tropical Mexico City.

The Hartzell full-feathering, constant-speed propeller is the simplest model available, and the lowest priced. No auxiliary equipment other than a governor are required for its operation.

Write today for complete details on this propeller. If you fly a single-engine airplane, ask about the highly efficient Hartzell constant-speed propeller.



HARTZELL
PROPELLER COMPANY
DEPT. A PIQUA, OHIO

R.C.A.F. AIR-SEA RESCUE
AB 664
TU
An OTTER of R.C.A.F. Unit Churchill—at 0107 hours Aug. 30/53
made a spectacular landing on a tiny Arctic lake at the scene
of a Lancaster Bomber crash and successfully evacuated
the complete crew of eight and their equipment—
IN A SINGLE FLIGHT!

DESIGNED AND MANUFACTURED BY
THE DE HAVILLAND AIRCRAFT OF CANADA LIMITED
POSTAL STATION "L" TORONTO ONTARIO

■ EDITORIAL INDEX

UNITED AIRCRAFT CORP.
Factory data and 1953 sales, including Chance Vought Aircraft, Hamilton Standard Propeller, Pratt & Whitney Aircraft and Sikorsky Aircraft Divisions, p. 316.

U.S. AIR FORCE
Aircraft on hand, p. 50.
Financing of 3,600 planes and spending $4 billion annually, p. 102.
Major USAF commands, p. 50.
Plane types on order, p. 50.

U.S. NAVY
Aircraft on hand, 1953, p. 56.
Plane types on order, p. 60.

U.S. ARMY
Aircraft types in lineup, p. 69.
Convertiplane projects, p. 70.
Evacuated 16,000 wounded, p. 69.
Helicopters prove valuable, p. 69.
New airpower concept gaining favor, p. 65.
Spending outlook about $50 million annually, p. 102.

V

VOUGHT AIRCRAFT
Military aircraft specifications, p. 196.
Plant data, p. 316.

W

WEST COAST AIRLINES
Scheduled operations data, p. 163.

WESTERN AIR LINES
Scheduled aircoach data, p. 166.
Scheduled operations data, p. 163.

WESTINGHOUSE ELECTRIC CORP.
Employment, 1953 sales, p. 316.

WRIGHT AERONAUTICAL DIVISION, CURTISS-WRIGHT
Factory data and 1953 sales, p. 316.
Piston-engine specifications, p. 216.
Turbine-engine specifications, p. 220.

Where to Buy

PRODUCTS - SERVICES
ACCESSORIES

STAINLESS STEEL FASTENINGS OF ALL TYPES

RIGHT OFF THE SHELF

• Sheet Metal Screws • Machine Screws • Cap Screws • Set Screws • Wood Screws • Nuts, Washers, etc. • Class 3 AN Drilled Fillister Heads • Titanium Bolts Now Available; Inquiries Invited. PROMPT DELIVERIES ON SMALL OR LARGE QUANTITIES. Fast service on special screw machine products. Write for complete descriptive catalog.

Star STAINLESS SCREW CO.
ARmory 4-1240
234 Union Ave. • Paterson 2, N. J.
Direct NEW YORK telephone: Wisconsin 7-9041

SPECIAL SERVICES TO THE AVIATION INDUSTRY

AIRCRAFT DEALERS

OWNER & BUYERS OF
Executive and Airline Aircraft
"Deal With Experience"
Our 30 years experience as one of the oldest and largest reputable buyers and sellers of transport aircraft should assist you in making your selection to delegate us to handle your aircraft purchase or disposal problems. Make us your clearing house for listings and inquiries.
FRANK AMBROSE
Box 181 Miami Int'l Airport. Miami 48, Fla.

Remmert-Werner, Inc.
Lambert Field, St. Louis, Mo.
Executive Aircraft

DC-3 Lodestar D18S
Conversion-Maintenance-Parts
Complete Services and Sales

LEASING

FOR DC-3 LEASE
DC-3 available, with crew, for long term lease to Corporation. Very reasonable. Airstair Door. Full equipment.
FL-1544, Aviation Week
330 W. 42 St., New York 36, N. Y.

INSURANCE

AVIATION INSURANCE SPECIALISTS
RICHARD J. BERLOW & Co., Inc.
Teterboro (N. J.) Airport
HAsbrouck Heights 8-1091

PARTS & SUPPLIES

IT'S TRUE!
INVERTERS is only one of the many things we sell
An Ever Growing List of Satisfied Customers Is the Best Evidence.
Don't Shop Around - Write - Phone - Wire
Act Today .....Rush Service
CLARENCE CARRUTHERS, INC.
AERONAUTICAL SUPPLIES
79 WALL ST. NEW YORK 5, N.Y.
HA 2-5934-5 CABLE CLARCARRU, N.Y.

C.A.B LTD
49 OLD BOND ST., LONDON W1, ENGLAND
P. AND W. 1830/92 spares from stock; cylinders, pistons, connecting rods, valves, rings, crankshafts, gears, housings, front and rear covers, bearings. Standard and oversize. C.A.B. Ltd., 49 Old Bond St., London, W.1. Phone, Mayfair 0035. Cables, "Centaero, London." 217-20

NAVCO INC.
Lambert Field
St. Louis, Mo.
TErryhill 5-1511
Has all Parts and Supplies for Executive
DC-3 LODESTAR BEECH
Airframe Engines Radios
A.R.C. Bendix Collins Lear Sperry Wilcox
P&W Continental Wright Goodrich Goodyear

IF YOU RENDER A SERVICE TO THE AVIATION INDUSTRY YOU SHOULD INQUIRE ABOUT THIS NEW SECTION!
Write
Classified Advertising Division
330 W. 42 St., New York 36, N. Y.

CONTRACT WORK WANTED

AAA Engineering Company
AIRCRAFT ARMAMENT AUTOMOTIVE
MANUFACTURING AND TOOLING
Design, Tool & Fabricate-Titanium Precision Forming
SAWYERVILLE, ILLINOIS AND HIGHWAY 140 & OLD HALLS FERRY BELAIRE, St. Louis County, Missouri
Phone: Turner 6-1033

Bendix

Bendix Products Division
South Bend, Indiana

AIRCRAFT POWER PLANT CONTROLS ENGINEER

Duties: To direct analyses and tests in aircraft power plant projects aimed at establishing static and dynamic control system requirements.

Requirements: B.S. degree in mechanical or aeronautical engineering, plus approximately 5 years experience in analysis and testing of aircraft power plants or components, preferably gas turbine, hi-speed compressors, turbines, or turbo machinery; control experience desirable, also familiarity with dynamic gear such as oscillographs, computers, or servos.

ELECTRICAL RESEARCH ENGINEER

Duties: Laboratory investigations and developmental techniques relating to servo-mechanisms, components, and aircraft power plants. Will supervise others.

Requirements: B.S. in electrical engineering with emphasis on electronics, feed-back and servos. A minimum of 5 years in research and design relating to electrical and magnetic circuits and components, specific experience in magnetic amplifier design desirable.

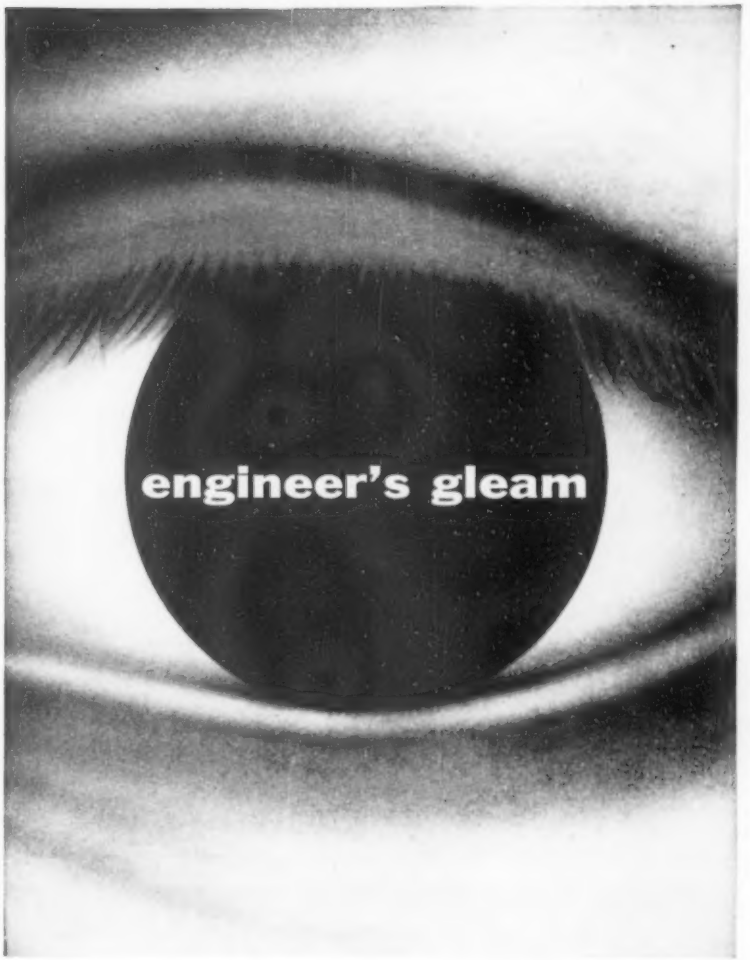
Other Engineering Opportunities In Aircraft Landing Gear and Missile Activity

Send resume of education and experience to:

EMPLOYMENT DEPARTMENT — TECHNICAL PERSONNEL

BENDIX PRODUCTS DIVISION

BENDIX AVIATION CORPORATION
South Bend, Indiana



If your eye lights up when the challenge is a big one, when the stakes are high, when the only ceiling is your own ability . . . if you're willing to tackle long, hard work on difficult and precarious undertakings . . . if you're a creative engineer with a gleam in your eye, then this is it! No plush inducements. Only the opportunity to work with the finest mindpower and facilities in the whole new world of spaceborne systems—on a top-priority problem.

If it's only a job you want, the woods are full of them. But if you are one of the few who are destined to go far in this industry, you'd be wise to take an engineer's-eye view of the mindpower and the facilities you'll be working with.

Write to J. M. Hollyday, Director of Employment, Dept. AB-9

Martin AIRCRAFT — **THE GLENN L. MARTIN COMPANY**
BALTIMORE • MARYLAND

Cessna

ENGINEERING OPPORTUNITIES

with world's leading producer of light commercial airplanes

for

- **Design Engineers**
- **Design Draftsmen**
- **Research Engineers**

Send Resume to Employment Manager

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

Engineers

THERE IS A POSITION FOR YOU

AT Hayes

AIRCRAFT CORPORATION
BIRMINGHAM, ALABAMA

aircraft maintenance engineers wanted to handle engineering in:

- SHOP LIAISON
- POWER PLANT & PROPELLER OVERHAUL
- FLIGHT LINE OPERATION
- HYDRAULIC & FUEL SYSTEMS
- ELECTRONIC EQUIPMENT & INSTALLATION

positions are also open in technical publications for technical:

ILLUSTRATORS & WRITERS

Write to:

Executive Engineer—Hayes Aircraft Corporation
P. O. Box 2287, Birmingham, Alabama

Engineer

Two Interesting Positions as

VIBRATION ENGINEERS

Both positions require men with a degree in mechanical, aeronautical or electrical engineering, theoretical and applied mechanics, or physics. In addition—

One position requires . . .

A man with formal education in vibration analysis with emphasis on theoretical approach.

The second position requires . . .

A man with practical experience in solving vibration problems either on rotating machinery or aircraft.

We are now in the midst of the largest new product program in our history. In addition to excellent salary and job security, there is good chance for advancement as our line grows. Our new plant is ideally located midway between Hartford, Conn., and Springeld, Mass. We help you to locate a home in either urban or rural areas and to pay moving expenses.

Please write us about your qualifications and experience. All replies confidential. Address Mr. Henry Wakeman at

HAMILTON STANDARD
Division of
UNITED AIRCRAFT CORPORATION
25 Bradley Field Rd.
Windsor Locks, Conn.

ENGINEERS

Attractive Positions
with
TEMCO
IN DALLAS, TEXAS

For Details See
MARCH 1 AVIATION WEEK
or Write
E. J. HORTON
Engineering Personnel
BOX 6191
DALLAS, TEXAS

MECHANICAL or AERONAUTICAL ENGINEER

with training or experience in business administration, to organize and conduct PERSONNEL and PUBLIC RELATIONS activities in our aggressive, rapidly growing company.

An excellent opportunity for a young man interested and qualified in these areas.

EXPERIMENT INCORPORATED
Richmond 2, Virginia

SERVICE ENGINEER

M.E. or A.E. experience on aircraft engines or accessories desirable. Aircraft or airline background. Willing to relocate in major city for long term assignment. Send resume to R. T. Bartlett, Stratos Division, Bay Shore, L. I., N. Y.

STRATOS
a Division of Fairchild Engine & Airplane Corp.
Bay Shore, L. I., N. Y.

OPENINGS IN HELICOPTER EXPRESS AND PASSENGER PROGRAM

Traffic, Materiel Control
Supply, Cargo, Accounting, Audit
Ground Operations

LOS ANGELES AIRWAYS, INC.
Box 10155 Airport Station Los Angeles 45, Calif.

ENGINEERS

Expanding New England Firm of research engineers has the following openings:

AERONAUTICAL, CIVIL & MECHANICAL
— In the fields of —

Aerodynamics	Vibration Analysis
Dynamics	Structures
Aeroelasticity	Instrumentation

Position also available for an experienced
APPLIED MATHEMATICIAN

Please send complete resume of education and experience to

ALLIED RESEARCH ASSOCIATES, INC.
43 LEON STREET, BOSTON 15, MASS.

Your Inquiries to Advertisers Will Have Special Value . . .

—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publishers to secure more advertisers and—more advertisers mean more information on more products or better service—more value—to YOU.

Engineers and technical personnel with experience in any phase of military aircraft research, design, development and test will find excellent employment opportunities available at Chance Vought Aircraft. These vacancies also include openings for specialists in fields such as Armament Design, Antenna Design, Guidance, Aerodynamics and Technical Writing. These positions involve assignments to either fighter aircraft or guided missile projects such as the XF8U, the Navy day fighter or the Regulus missile.

Individuals interested in these opportunities may submit letters of application to

CHANCE VOUGHT AIRCRAFT
INCORPORATED

Supervisor of Engineering Personnel
P. O. Box 5907
Dallas, Texas

Engineering Personnel Representative
150 Causeway Street
Boston, Massachusetts

BELOW: *Home of Chance Vought Aircraft, Incorporated, Dallas, Texas.*

UNUSUAL OPPORTUNITIES

FOR QUALIFIED ENGINEERS

Join the happiest aircraft family in sunny San Diego. Outstanding employee benefits including profit-sharing, low-cost group insurance and medical care, free polio insurance for yourself and family, paid tuition for university night school courses, periodic salary merit and adjustment reviews, paid vacations, transportation allowance, and many others.

JET ENGINE ANALYST

Responsible position for qualified engineers with strong aero-thermo background, familiar with turbojet engine cycle analysis, and capable of determining engine performance perimeters at various flight speeds and altitudes. Must be graduate engineer with minimum of 3 to 5 years experience in aircraft gas turbine field.

MECHANICAL DESIGN ENGINEER

Requires mechanical engineering degree and five years experience in design of gas turbines or similar type machines. Must be capable of making layouts of complete parts and components taking into consideration manufacturing costs, weight, stress, mechanics and production problems.

WRITE TO

SOLAR
AIRCRAFT COMPANY
2200 PACIFIC HIGHWAY
SAN DIEGO, CALIFORNIA

SENIOR PROJECT MECHANICAL ENGINEER

to head up the Design of

HYDRAULIC ACTUATOR & VALVES for AIRCRAFT

Our Company has been established for 15 years and requires new Designs to expand our present production in this field.

Unusual compensation in terms of straight salary (High) plus profit sharing in proportion to personal results is available to the right man who must have an excellent background and is now directly engaged in design and development in this field.

Empire Tool Products, Inc.

1075 STEWART AVENUE — GARDEN CITY, L. I., N. Y.

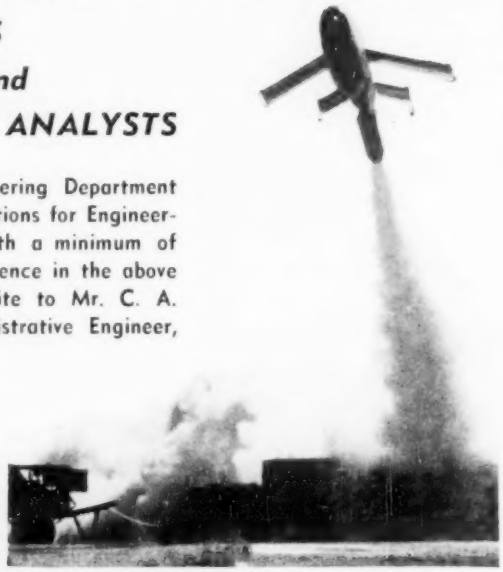
SERVOMECHANISMS and AUTOMATIC CONTROLS

DESIGNERS

and

ANALYSTS

Expanding Engineering Department has excellent positions for Engineering graduates with a minimum of three years experience in the above fields. Please write to Mr. C. A. Cordner, Administrative Engineer, giving details of education, experience and salary requirements.

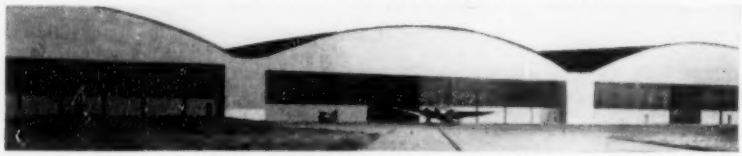


RYAN AERONAUTICAL COMPANY

Lindbergh Field, San Diego, Calif.

SPACE NOW AVAILABLE

NEW EXECUTIVE AIRCRAFT HANGARS



Catering to Executive Aircraft

- Long term leases
- Office and shop space
- Twin Beeches through DC 6's
- 24 hour service—all weather operations
- Maintenance—parts inventory
- All octane fuels
- Transient service
- Public taxis—helicopter service
- Adjacent airline terminal bldg.
- Air taxi—charter service
- Executive aircraft sales
- 40 minutes to Times Square

WRITE - WIRE PHONE

WESTAIR Inc.

Westchester County Airport

WHITE PLAINS NEW YORK

Light engineering company is interested in acquiring modern, up-to-date products for manufacture in United Kingdom, under licence on a royalty basis. Field of interest.

Sheet Metal-Steel & Aluminium

Machine Tooling

Electronics & Electrical Devices

Plastics & Synthetics

BRITISH EMULSIFIERS LTD.

3 Red Place, London, W.1. England

UNUSUAL OPPORTUNITY

For young woman in Market Research Department of leading Aeronautical Business Magazine. Must be capable researcher and writer with Aviation background. Please submit your qualifications in detail by letter.

P-2044, Aviation Week
330 W. 42 St., New York 36, N. Y.

UNUSUAL OPPORTUNITIES

can be found each week in the

SEARCHLIGHT SECTION

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITION VACANT

WANTED: HELICOPTER mechanics—Bell or Sikorsky experience. Domestic and foreign work. Good pay, permanent employment. P-1711, Aviation Week.

SELLING OPPORTUNITY OFFERED

EXPERIENCED AIRCRAFT salesman to take charge of state distributorship of popular twin-engine aircraft. Real opportunity for the man who can sell $50,000 to $100,000 planes in the southwest. Backed by a strong aviation operation on a popular airport. Salary and bonus arrangement. Write giving experience, educational background and references. Only those with successful experience in selling aircraft of above type need apply. Write Box SW-1929, Aviation Week.

POSITIONS WANTED

SALES EXECUTIVE, public relations, advertising experience in both product or company, also in traffic and cargo. PW-1860, Aviation Week.

AIRLINE PILOT, age 33, 8200 hrs. ATR DC-3, DC-4, C-46, desires position with foreign based organization. PW-2032, Aviation Week.

AIRLINE PILOT, age 32, married, ATR rated DC-3, C-46, 5,500 hours. Desire position as pilot. PW-1944, Aviation Week.

EXECUTIVE OR Helicopter pilot, age 32, married, desires foreign or domestic position. 200 helicopter (all rotor types) 2000 hours fixed wing (Beech and single engine). SMEL, instrument and helicopter ratings. No college. PW-1953, Aviation Week.

EXECUTIVE PILOT with commercial single & multi engine, 8500 hrs, 750 hrs actual instrument. Airline & Executive experience. Flown everything from cubs to DC-4's as Captain. Three trips around the world as Captain. Sales and business background. 750 hrs over the Himalayas as Captain. Four engine. Married, four children, go anywhere. Over 100 Ocean crossings. PW-2026, Aviation Week.

ELECTRONICS ENGINEER or Technician. Radar Observer Navigator, 9 years electronics experience, 2000 hours flying time, former Electronics Officer USAF. Will go anywhere in the world. Single, age 31. PW-2012, Aviation Week.

AIRLINE PILOT 12,800 hours, SMEL, ATR rated DC-3, DC-4, C-46. International and recent domestic experience. A&E Mechanics license. Desire executive or corporation position. Will consider all offers. PW-1991, Aviation Week.

DESIGNER—20 years experience in design and engineering in both manufacturing and operation of airframes and engine installations. Have done contact and shop work. PW-1977, Aviation Week.

INVESTMENT OPPORTUNITY — Manufacturers: For $10,000.00 a year make a wise investment for your company that will pay regular premium dividends. Investment, possesses values hard to find—Loyalty, Integrity, Ambition, Intelligence, Honesty, Imagination, Education, plus three years experience in Government Contract Administration and Procurement of Aircraft Electronic Equipment. For details PW-1952, Aviation Week.

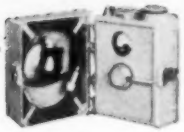
PROJECT ENGINEER desires position with small progressive manufacturer of aircraft mechanical equipment. Aeronautical engineering degree. Expegience includes 13 years design, testing, field work and responsible supervision. PW-2040, Aviation Week.

FOR SALE

World's largest stock new and used aircraft parts, engines and supplies. Free Lists. Financing. Vestco, Dept. F, Box 5306 T.A., Denver, Colo.

U. S. Government

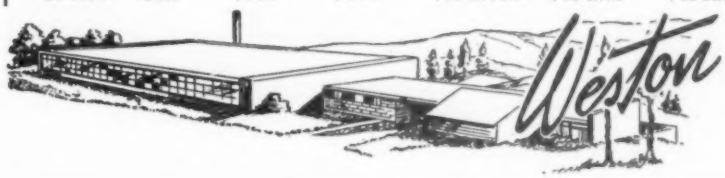
Tenders are invited by the Government of India for the supply of 10 Nos. Fire Crash Tenders and Maintenance spares. Copies of the tender-sets may be obtained from the Director, India Supply Mission, 2536, Massachusetts Avenue, N.W., Washington S, D. C. on payment of $2.50 each. The bids are to be submitted direct to the Director General, Supplies & Disposals, Shahjehan Road, New Delhi (India) so as to reach him before 27th April, 1954.



Mr. PURCHASING AGENT

Solve your electronic test equipment problem by referring it to us. For many, many years now, we have been an invaluable source of supply to the Air Frame Manufacturers in this country and Canada. It is not generally realized that from this single plant, more than one hundred different types of Military electronic test equipment are available. Even if what you are looking for, is not contained in the list that follows, do not hesitate to write. Chances are, we have it available for immediate delivery.

AN-APA-10	BC-595-TU	1-117	1-212	OAW	TS-32A TRC-1	TS-89 AP*	TS-148 UP*	TS-218 UP		TS-338
AN-APR-1	BC-1060A	1-122	1-222 A	P4	TS-33 AP	TS-90*	TS-153	TS-220 TSM		TS-350A U
AN-APR-4	BC-1066A	1-126	1-223 A	P4E	TS-34 AP	TS-92 AP	TS-155	TS-226A		TS-361 U
AN-TSM-4	BC-1201A	1-130A	1-225	SG-8 U	TS-35 AP	TS-96 TPS-1	TS-159-TPK	TS-230B		TS-375
AN-UPM-13	BC-1203	1-134B	1-233	TAA-16WL	TS-36 AP	TS-98 AP	TS-164 AR	TS-232 TPN-2		TS-377 U
AS-23	BC-1236 A	1-135	1-245	TS-1ARR	TS-39 TSM	TS-100 AP	TS-170 ARN-5	TS-239B		TS-389 U
AT-67	BC-1255 A	1-137A	1E-21A	TS-3AP AP	TS-45 APM-3	TS-101 AP	TS-173 UR	TS-250 APN		TS-418
AT-68	BC-1277	1-139A	1E-36	TS-8A U	TS-46 AP	TS-102 AP*	TS-174 U	TS-251		TS-419
AT-39	BC-1287A	1-140A	1F-12 C	TS-10A APN-1	TS-47 APR	TS-108 AP*	TS-175 U*	TS-257 AWR		TS-421 U
AT-48	1-48B	1-145	1S-185	TS-11 AP*	TS-51 APG-4	TS-110 AP	TS-182 UP	TS-263		TS-433 U
BE-67	1-49	1-147	1S-189	TS-12 AP*	TS-55 AP	TS-111 CP	TS-184 AP	TS-268B*		TS-465 U
BC-221*	1-56	1-153A	LAD	TS-13 AP*	TS-56 AP	TS-117 GP*	TS-189 U	TS-270A		TS-480 U
BC-376	1-61B	1-157A	LAE-2	TS-14 AP	TS-59	TS-118 AP	TS-192 CPM-4	TS-281 TRC-7		TS-505
BC-438	1-83A	1-167	LAF	TS-15B AP	TS-60 U	TS-125 AP*	TS-194 CPM-4	TS-285 GP		TS-589 U
BC-439	1-86A	1-168	LM*	TS-16 APN	TS-61 AP	TS-127 U	TS-195 CPM-4	TS-293		TS-615 U
BC-638	1-95A	1-177	LU-2	TS-18	TS-62 AP	TS-131 AP	TS-197 CPM-4	TS-297*		TS-616 U
BC-639	1-96A	1-178	LU-3	TS-19	TS-63 AP	TS-138	TS-198 CPM-4	TS-301 U		TS-617 U
BC-906D	1-97A	1-186	LZ	TS-23 AP	TS-65A FM2-1	TS-142APG	TS-203 AP	TS-303 AG		TS-620 U
BC-918B	1-98A	1-196A	ME-6 U	TS-24 APM-3	TS-69A	TS-143 CPM	TS-204 AP	TS-311 FSM-1		TSX-45E
BC-923A	1-106A	1-198A	OA	TS-24 APR-2	TS-76-APM-3	TS-144 TRC-6	TS-205AP	TS-323		TSS-45E
BC-936A	1-114	1-203A	OAA-2	TS-26 TSN-1*	TS-78 U	TS-146	TS-207	TS-324 U		TVN-8SE
BC-949 A	1-115	1-208	OAK	TS-27 TSM	TS-87 AP	TS-147 AP*	TS-210 MPM	TS-328		TUN-8HU
										TTX-10RH



LABORATORIES, INC.

HARVARD, MASS.

Tel: HARVARD 250—AYER 300—TWX HARV 193

Cable: WESLAB

LOCKHEED PV-1

HAVE TWO AVAILABLE

FOR IMMEDIATE SALE

70 HOURS TOTAL SINCE NEW

EXCEPTIONALLY CLEAN. WILL STAND MOST RIGID INSPECTION. SHIPS UN-CONVERTED. MAY BE INSPECTED AT OUR FORT WAYNE BASE.

CALL OR WRITE

LEEWARD AERONAUTICAL

P. O. Box 210 PHONE: H-2145
FORT WAYNE (BAERFIELD) INDIANA

SUPER-92

over **200** mph for your **DC-3**

CAA Approved R1830-SUPER-92 engines allow 700 HP normal cruise, better single engine—lower fuel and maintenance mileage costs with 20,000 extra miles between changes, with same overhaul intervals and costs as —92. Fully interchangeable with —92 —same weight, mounts, cowls, lines, etc. Proven by thousands of hours of practical executive operation.

ENGINE WORKS

LAMBERT FIELD INC. ST. LOUIS, MO.

PRATT & WHITNEY WRIGHT — CONTINENTAL LYCOMING

SALE — CAA OVERHAUL — EXCHANGE

Douglas DC-3 Airliner

Serial No. N17319; 00:00 hours since re-license —Fly away today. Number of passenger seats fitted—21; galley and lavatory installed. Standard passenger type of TWA; Engines: P & W R1830-92, 00:00 time since overhaul; Radio: MN-62A, ADF, Army, ILS, ARC-1, 50-channel VHF; Western Electric Marker Beacon Receiver; Air Communications Range Receiver. Immediate **$76,000**

Lockheed Lodestar N54549

Aircarrier licensed, Ser. 2008; Extra 1820-87; NTSO Eng. (2); Airline interior; Radio: ARC-1 20-channel, 2 MN-62B ADF, Marker Beacon Receiver; New Tires, Painted White Top, Red Strip **$48,000**

ALLIED Aircraft Co.

5536 Satsuma Avenue, North Hollywood, California

Phone: STANLEY 7-2151

FOR SALE

PBY 5A

Total airframe 2850 hours. Since overhaul 300 hours. Engines 1830-92 with 300 hours since overhaul. Good radio. Auto pilot. Cargo floor. Cargo door. Turrets faired in. Center compartment lined and carpeted. Must be sold. Make offer.

Owners, WESTAIR, INC.
White Plains, New York

AIRPLANE ENGINE HOISTS

Model A2A – Portable – Capacity 3000 lbs. Good General Purpose Hoist

Send for Booklet.

VIMALERT COMPANY, INC.

807 Garfield Ave. Jersey City 5, N. J.

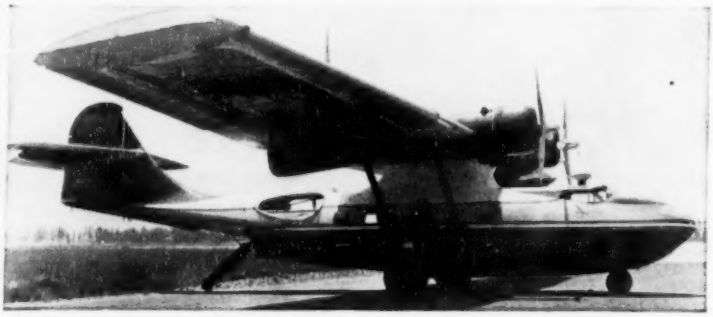
FOR SALE

LOCKHEED LODESTAR

New license on sale. 900 hours since airframe major. Zero time 1820-87 engines on sale. Zero time props. 24 volt. Beautiful airline interior. Must be sold. Make offer.

Owners: WESTAIR, INC.
White Plains, New York

PBY5A Specialists



Complete Overhaul & Maintenance of All Types of Aircraft

WE HAVE SEVERAL PBY5A AIRCRAFT FOR SALE
DISTRIBUTORS FOR BENDIX & LEAR RADIO
DEALER FOR COLLINS RADIO

Southern California Aircraft Corp.

Box 433 — *Ph: Ontario 6-3871* — Ontario, Calif.

TWIN-BEECHCRAFT
D18S "EXECUTIVE" FOR SALE

Manufacturer's Serial No. A198—built September, 1946—licensed to February, 1955—Pratt & Whitney 985—14B's—total time both engines—1998:32—zero time since overhaul—Hamilton Standard hydromatic propellers—standard 24 volt system—standard fuel installation with 50-gallon nose tank—radio consists of: 1 ea. ARC-5 Transmitter, 1 ea. ARC T-11A transmitter, 1 ea. 3105 transmitter, 3-light marker beacon, 1 ea. Lear 36-channel transceiver, 1 ea. ARC-3 10-channel receiver, 1 ea. ARC-15 tuneable receiver, 1 ea. Bendix ADF receiver, 1 ea. Bendix LF receiver, 1 ea. Glide Path flag alarm (Omni Localizer)—executive type interior—four chairs, lavatory installed, and coffee galley—**PRICE: $57,500 F.O.B.**

L. B. S. AIRCRAFT CORP.
MIAMI, FLORIDA
Contact today - Available immediately

FOR SALE
LATEST MILITARY JET TYPE FOUR BAND BENDIX A D F
Like new and complete, including Radio Compass Unit, Control Box, Indicator, Iron Core Loop, and all mountings, shafts, plugs and cables.
Price $1750.00
GEORGE MOKSKI
10905 Fawcett Avenue — El Monte, California

DOUGLAS C-54-E

SALE OR LEASE
N4888V—80 Passenger Airliner
Now undergoing major overhaul and modification.
T.T. 12,681:00
Engines to suit user.
C.A.A. Aircarrier, licensed and radio

CONTACT: L. H. CAMERON, Stanley 7-2151
5514 SATSUMA AVE., NORTH HOLLYWOOD, CALIF.

For Immediate Sale
REILY TWIN NAVION

Total time 300 hrs since conversion; 150 HP engines, 200 hrs total time on engines; full feathering Hartzell Propellers—200 hrs total time; Lear A.D.F.; Omni and 2 way VHF; Southwind Heater; Painted gray, green and white; complete instrumentation.

Attractively priced.

***Contact:* NEIL FULTON**
LINTHICUM, MD.
Phone 624R

OPENING NOTICE
You will meet the old familiar gang at
AVIO SUPPLY CORPORATION
129 Pierrepont St., Brooklyn 1, New York
Telephone: ULster 8-0750 • *Western Union:* "WUX BKLYN"
DISTRIBUTORS and PURCHASING AGENTS for all types of
AIRCRAFT PARTS
ENGINES • ACCESSORIES • SPARES • AIRFRAME • ENGINE PARTS
RADIO and ELECTRONICS
"You can depend on our Experience and Reputation"
AUBREY L. MOSS, *Pres.*
FRANK VITELLI, *Sales Manager*

FOR SALE
DOUGLAS C-47 B
(Licensed)

Total airframe time 14810 hrs.
Airframe time since overhaul 5800 hrs.
Engines: P & W R-1830-92
Engine time since overhaul: 617 left/848 right
Propellers: Hamilton Standard—Paddle blade
Propeller time since overhaul: 0 hours
Radio: Dual ADF—ILS—VHF—Command transmitter and receiver—Western Electric marker beacon receiver—Glide path receiver.
Interior: cargo, cargo door, cargo floor. **Suitable for executive conversion.**
Will **overhaul** to customer's specifications.

WESTAIR, INC.
Westchester County Airport
White Plains, N. Y.

? **HAVE YOU SEEN THE NEW SECTION** ?
SPECIAL SERVICES TO THE AVIATION INDUSTRY
Appearing for the first time on page 340. If you have a service to render to the Aviation industry you can make and keep contact with your potential customers at a reasonable cost through your use of this section . . . For more information write:
CLASSIFIED ADVERTISING DIVISION
McGraw-Hill Publishing Company
330 West 42nd St., N. Y. 36, N. Y.

WORLD'S LARGEST STOCK!

All parts listed—plus many more—are always carried in our huge stock of unused aircraft parts, accessories, AN and NAS hardware. Let us screen your inquiries.

AIRCRAFT ACCESSORIES

Description	Mfg.	Part No.	Quan.
Pump	Pesco	1H-260K	195
Pump	Thompson	TFD8600	75
Cylinder Hyd.	Grumman	5359404	417
Heater	Surface Combustion Co.	83A9	6
Heater	Stewart Warner (200,000 BTU)	921B	230
Blower	Dynamic Air Engine	4582-AA-6C	18
Blower	Joy Manufacturing Co.	U-702-15	24
Tank Unit	Minn. Honeywell	G-1098D	11
Trim Tab Controller	Pioneer	15701-1A	15
Oil Cooler Assembly	U.A.P.	U8416-MM	12
Oil Cooler Assembly	U.A.P.	U8013-MM	14
Hydraulic Pump	Vickers	MF9-713-15H	120
Hydraulic Pump	Vickers	PF12-713-25BCE	124
Hydaulic Pump	Vickers	PF4-713-20BCE	327
Hydraulic Pump 3000 P.S.I.	Vickers	MF45-3911-20Z	43
Hydraulic Cylinder	Air Associates	HC2109	29
Hydraulic Cylinder	Air Associates	HC2110	8
Fire Detector	Edison	117-47	46
Fire Detector	CO_2 Mfg. Co.	ASDC2	65
CO_2 Cylinders	Kidde	981280	185
CO_2 Cylinders	Kidde	M870036B	47
Anti-Icer Pump	Adel	D7818	125
Auxiliary Power Unit	Eclipse	NEP-2	29
Auxiliary Power Unit	Lawrence	LER-30D	16
Pump	Pesco	1E-621	8
Pump	Pesco	2E258SA	21
Separator	Pesco	3V-217-HC	32
Accumulator	Vickers	AA14002A	35
Actuator	Air Associates	M-2031	22
Wobble Pump (D-3)	Erie Meter	AN4014	17
Oxygen Cyl.	Kidde	923748	74

ENGINE ACCESSORIES

Starter	Eclipse	1416-12E	75
Generator	Eclipse (NEA-3A)	716-3A	100
Starter Motor	Jack & Heinz	JH950-R	90
Generator	G.E.	2CM46A2	4
Generator	Eclipse	1003-4	71
Carburetor	Stromberg	PD12K10	550
Carburetor	Stromberg	PR48-A1	236
Carburetor	Holley	1685-HAR	90
Carburetor	Holley	1375-F	19
Magneto	Scintilla	SF9-LN-2	407
Fuel Pump	Pesco	2P248EB	6
Fuel Strainer	U.A.P.	U635A	76
Governor	Woodward	5x18	10
Prop. Reversing Control	Ham. Standard	72400	20
Oil Separator	Eclipse	564-2A	384
Oil Filter	Purolator	27314	100
Pressure Relief Valve	Aerotec	V301B7	20
Tachometer	Eclipse	2227-11-D3A	11
Vacuum Pump	Eclipse	610-2C	6
Spark Plugs	Aero	LS4-AD1	185,000

AIRCRAFT ENGINES & PARTS

Engine	Wright	R-1820-52	1
Engine	Wright	R-1820-54	16
Engine	Wright	R-1820-60	4
Engine	P & W	R-1830-43	1
Bearing	P & W	1045A	166
Flange	P & W	3506	500
Follower Assy.	P & W	8288	130
Blower Assy.	P & W	3M814	814
Shaft	P & W	48362	53
Shaft	P & W	48363	75
Gear	P & W	48461	390
Gear	P & W	76236	78
Bearing	P & W	84289	1178
Housing	P & W	84487	113
Nose Housing	P & W	84591C	77
Crankcase Assy.	P & W	84350-D	200
Pump Assy.	Wright Aero	420313	33
Drive Assy.	Wright Aero	416421	46
Q.E.C. Unit		FM1	36

AIRCRAFT ENGINES & PARTS (Contd.)

Description	Mfg.	Part No.	Quan
Q.E.C. Unit		PY4M(B24)	17
Bearing	Torrington	NR6L12	25790
Bearing	Fafnir	AN200-K3L2	18273

GAUGES

Compass	Eclipse	36001-0	20
Gyro Indicator	Eclipse	14601-1F-B1	11
Gyro Indicator	Eclipse	10078-1AG	62
Position Indicator, Wheel & Flap	Weston	AN5780-2	400
Position Indicator, Wheel & Flap	G.E.	AN5780-2	1000
Position Indicator, Wheel & Flap	Eclipse	20100-11C-4-A1	23
Pitch Trim Gauge	Eclipse	15100-1B-A1	19
Cowl Flap Indicator	G.E.	8DJ29AAY	21
Oil Temp. Indicator	Lewis	77C3	23
Oil Temp. Indicator	Lewis	77C4	13
Oil Temp. Indicator	Weston	828TY13Z9	71
Manifold Pressure Gauge	Manning, Maxwell & Moore	AN5770-2	28
Fuel Quantity Gauge	Eclipse	3801-3B	128
Dual Carb. Temp. Gauge	Weston	828TY12Z9	40
Carb. Air Temp.	Lewis	77C3	22
Carb. Air Temp.	Weston	119862	40
Air Temp. Gauge	Weston	727TY70Z9	11
Air Temp. Gauge	Weston	727TY72Z9	85
Air Temp. Gauge	Weston	727TY73Z9	88
Air Temp. Gauge	Weston	727TY74Z9	83
Air Temp. Gauge	Weston	728-40Z9	10
Air Temp. Gauge	Weston	727-TY37P	298
Air Temp. Gauge	Lewis	47B22	33
Air Temp. Gauge	Lewis	47B23	28
Air Temp. Gauge	Lewis	47B24	54
Air Temp. Gauge	Lewis	47B21	30
Cyliner Head Temp.	Lewis	76B19	8
Torque Indicator	Eclipse	20100-42B-14A2	9
Tachometer Indicator	G.E.	8DJ13ABK	6
Tachometer Indicator	Eclipse	2222-1F-2A	200
Magnesyn Pos. Indicator	Eclipse	20000-8-A14	9
Magnesyn Transmitter	Eclipse	20000-43A-13A1	8
Magnesyn Indicator	Eclipse	23000-2A	67
Pressure Transmitter	Eclipse	22101-11-A4	15
Pressure Transmitter	Giannini	47114-D2.0-20	8
Differential Pressure Gauge	Kollsman	906-6-011	22
Differential Pressure Gauge	Kollsman	254BK-6-052	48

AIRCRAFT (RADIO)

Transmitter	Bendix Radio	TA-12B	20
Receiver	Bendix Radio	RA10-DB	35
Amplifier (PB10) W. ED. Mount	Eclipse	15401-1	10
Amplifier	Eclipse	12086-1C	11
Radio Noise Filter	G.E.	1C-200	740
Radio Noise Filter	G.E.	NF10084	959
Tube		JAN6AL5	327
Standing Wave Ind.	Hewlett Packard	415A	3
Antenna Switch	Bendix Radio	MS49A	26
Control	Bendix Radio	3616	81
Station Box	Bendix Radio	3620	23
Insulator	Bendix Radio	MT48C	518

ELECTRICAL PARTS

Plug	CAKZ	UG-21 U	1979
Transformer	Eclipse	DW33	11
Transformer	Eclipse	DW28	80
Transformer	Eclipse	DW47	33
Transformer	G.E.	70G3	26
Servo Motor	Transicoil	21300-20	57
Motor	G.E.	5BA40NJ1A	425
Motor	G.E.	5DP65-MB1	189
Motor	G.E.	5BA25D-J4B	44
Motor	Airesearch	26675	25
Motor	Diehl	FD65-5	21
Circuit Breaker	Spencer	PM-5	2094
Valve	Parker	AN5831-1	60
Valve	Eclipse	612-4A	130
Valve	Kohler	K1593-6D	1888
Valve (0-500PSI)	Bendix	146102	46

ELECTRICAL PARTS (Contd.)

Description	Mfg.	Part No.	Quan.
Circuit Breaker	Spencer	C6363-1-5A	115
Circuit Breaker	Spencer	C6363-1-2A	115
Circuit Breaker	Heinemann	AM1614-80	1700
Circuit Breaker	Cutler Hammer	6141-H69A	237
Amplidyne	G.E.	5AM31JJ9A	31
Amplidyne	G.E.	5AM31NJ10	111
Switch	Kidde	A-4614	151
Ignition Switch	Scintilla	AN3213-1	70
Ignition Switch	Nesco	A-9(94-3926)	250
Master Switch	Jos Pollack	M862A	66
Thermo Switch	Fenwall	17322-2	126
Heater Control Switch	White-Rodgers	1033-4E1	287
Air Ram Switch	Minn. Honeywell	PG208AS1	148
Air Ram Switch	Minn. Honeywell	PG208AS7	40
Pressure Switch	Aerotec	M-101-B	20
Pressure Switch	Eclipse	3135-11C	88
Impact Switch	Kidde	SA-3A	18
Switch	C.H.	8909-K99	2000
Dome Light	Grimes	AN3096-4	2585
Dome Light	Grimes	AN3096-5	775
Dome Light	Grimes	AN3096-6	1365
Plug	Cannon	NAF310310-4B	2747
Plug	Cannon	NAF310310-5B	402
Relay	Leach	7264-404	47
Relay	Leach	7210	24
Relay	Allied	BOBX-2	31
Relay	Square D	82A	718
Relay	G.E.	CR2791-G100-K4	281
Relay	G.E.	CR2792F101-A3	626
Relay	Guardian	G34464	41
Relay	Guardian	G31509-A	350
Relay	C. P. Clare	D2060	45
Control Box	Vapor Car Heating Co.	9804B	34
Compensator	Vapor Car Heating Co.	46B311	25
Solenoid	Interstate Aircraft & Eng. Co.	A812	202
Flex. Cable	Airesearch	25432	66
Temp. Control	Fulton Syphon	715E	52
Noise Filter	Mallory	NF3-5	500
Regulator	G.E.	3GBD1A18A	13

VALVES

Valve	Kidde	982585	326
Valve	Oh. Chem.	AN-60009-1B	325
Valve (3000 PSI)	Parker	2-1046-76	47
Restrictor Valve	Parker	SP4-2746-77	68
Restrictor Valve	Parker	SP4-2746-78	105
Restrictor Valve	Parker	SP4-2746-79	40
Restrictor Valve	Parker	SP4-2746-80	48
Restrictor Valve	Parker	SP4-2746-81	60
Restrictor Valve	Parker	SP4-2746-76	142
Restrictor Valve	Adel	18784	33
Cone Check Valve	Parker	PL2-2546-75	127
Cone Check Valve	Parker	PL2-2546-76	123
Cone Check Valve	Parker	PL2-2546-77	620
Cone Check Valve	Parker	PL2-2546-78	540
Check Valve	Parker	PLY-843-54	112
Check Valve	Parker	PL2-1846-77	23
Check Valve	Kenyon	19100-2-101B	67
Check Valve	Eclipse	557-5	9
Check Valve	U. S. Gauge	AW-CV-1-1	180
Valve	Parker	6-746-10	68
Valve	Vickers	AA31400	28
Restrictor Valve	Adel	18784	33
Lock Valve	Adel	12924-2	85
Brake Valve	Vickers	146102	22
Selector Valve	Parker	SP-1-445-8	7
Selector Valve	Adel	D9530	478
Selector Valve	Adel	D9530-2	668
Selector Valve	Adel	D9560-2	428
Selector Valve	Adel	D9632	179
Selector Valve	Adel	D9696	237
Selector Valve	Adel	D10044	744
Selector Valve	Adel	D10051	244
Solenoid Valve	United	37D6210 (AN4078-1)	2200
Magnetic Valve	General Control	AV1B1174	114
Throttling Valve		73-A-01	1865
Relief Valve	Airex	1965-900	240
Pressure Relief Valve	Aerotec	V301B7	20
Valve	Aero Supply	74247 (TyPH3)	814
Valve	Whitaker	AN5830-1	335
Valve	Whitaker	AN5830-6	74
Underwing Fueling Valve	Parker	7-2646-12	5
Disconnect Valve	Allen	5QD1800N	148
Drop Tank Valve	Allen	8QD1800B	53
Disconnect Coupling	Allen	38QD1800B	60

COMMERCIAL SURPLUS SALES CO.

4101 CURTIS AVENUE, BALTIMORE 26, MARYLAND **TELEPHONE: CURTIS 7-3300**

The
**Pioneer P-7B* P-9B*
*guide surface***
personnel parachute
descends with

minimum oscillation!

The Pioneer P7-B, P9-B Guide Surface Personnel Parachute is recognized by the aviation industry throughout the world as a great advancement in parachute design and is now definitely proven as the most efficient life-saving parachute used by jet plane pilots.

Less opening shock . . . *Less* oscillation . . . *Less* side drift . . . Jumper descends virtually *straight down* landing on his feet.

PARACHUTES MAKE THE DIFFERENCE!

**Patents applied for in U.S. and principal countries throughout the world.*

PIONEER PARACHUTE CO. INC.
MANCHESTER CONNECTICUT U.S.A.
CABLE ADDRESS PIPAR Manchester Conn U.S.A.

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—MARCH 15, 1954

A. C. SPARK PLUG DIV., G.M.C. ... 332
Agency—D. P. Brother & Co., Inc.
ADAMS RITE MFG. CO ... 138
Agency—The Shaw Co.
ADEL DIV., GENERAL METALS CORP ... 33
Agency—The McCarty Company
ADVANCE ELECTRIC RELAY CO ... 230
Agency—Western Ads Agency, Inc.
ADVANCE GEAR & MACHINE CORP ... 128
Agency—Mack Wharton Adv.
AERO DESIGN & ENGINEERING CO ... 241
Agency—Tom P. Gordon Co.
AEROJET ENG. CORP. (GENERAL TIRE & RUBBER CO.) ... 270
Agency—D'Arcy Advertising Co.
AERO INSTRUMENT CO ... 250
AERO SUPPLIES CO ... 321
AEROQUIP CORPORATION ... 32
Agency—Hoperaft-Keller, Inc.
AEROTEC CORPORATION, THE ... 135
Agency—Bentitz & Co., Inc.
AIR ASSOCIATES, INC. ... 38
Agency—DeGarmo, Inc.
AIR FRANCE ... 305
Agency—Buchanan & Co., Inc.
AIRBORNE ACCESSORIES CORP ... 4
Agency—Gray & Rogers Adv.
AIRCOOLED MOTORS, INC. ... 253
Agency—Richards & Webb, Inc.
AIRCRAFT-MARINE PRODUCTS, INC ... 18, 19
Agency—Reiner Advertisers
AIRCRAFT POROUS MEDIA, INC ... 152
Agency—Ciango Advertising, Inc.
AIRCRAFT RADIO CORP ... 316
Agency—Burke Dowling Adams, Inc.
AIRCRAFT TRADE SHOW ... 266
Agency—Alexander Smith Ads
AIRWORK CORP. ... 255
Agency—Grace Marston, Inc.
ALL AMERICAN AIRWAYS ... 327
Agency—Gaynor & Co., Inc.
ALLEN AIRCRAFT PRODUCTS, INC ... 107
Agency—The Fred Rock Adv. Co.
ALLIED INDUSTRIES, INC ... 274
Agency—Henderson Advertising Co.
ALUMINUM CO. OF AMERICA ... 180, 181
Agency—Fuller & Smith & Ross, Inc.
A.M.C. SUPPLIES ... 283
Agency—Parker Wilson Advertising
AMERICAN AIRLINES, INC ... 336
Agency—Ruthrauff & Ryan, Inc.
AMERICAN CHAIN & CABLE, PAGE STEEL & WIRE DIV. ... 256
Agency—Reincke, Meyer & Finn, Inc.
AMERICAN ELECTRIC MOTORS CO ... 247
Agency—Clyde D. Graham Adv.
AMERICAN ELECTRONICS MFG., INC ... 82
Agency—Clyde D. Graham Adv.
AMERICAN LATEX PRODUCTS ... Insert 61, 62, 63
Agency—Anderson, McConnell Adv. Agency
AMERICAN PHENOLIC CORP ... 268
Agency—Burton Browne Adv.
AMERICAN WELDING & MFG. CO ... 313
Agency—The Bayless-Kerr Co.
AMGEARS, INC. ... 30
Agency—C. Franklin Brown, Inc.
APPLIED SCIENCE CORP. OF PRINCETON ... 76
Agency—Paul M. Healy Adv. Service
ARMA CORPORATION ... Insert 36
Agency—Doyle, Kitchen & McCormick, Inc.
ARROWHEAD RUBBER CO ... 31
Agency—Dan Ebberts Adv., Service
AUBURN SPARK PLUG CO ... 70
Agency—Richards & Webb, Inc.
AVIATION DEVELOPMENTS, INC ... 312
Agency—Jayegart Co.
AVIEN-KNICKERBOCKER, INC., AVIATION ENGINEERING DIV. ... 171
Agency—Robert W. Orr & Associates, Inc.
AXELSON MFG. CO ... 118
Agency—C. B. Juneau, Inc.
B. H. AIRCRAFT CO., INC. ... 296
Agency—Harold Marshall Adv. Co.
BARBER COLMAN CO. ... 34
Agency—Howard H. Monk & Assoc.
BARNES CO., INC., W. F. & JOHN ... 131
Agency—Roy F. Cratty Agcy.
BENDIX COMPUTER DIV., BENDIX AVIATION CORP. ... 264
Agency—The Shaw Co.
BENDIX PACIFIC DIV., BENDIX AVIATION CORP. ... 94, 95
Agency—The Shaw Co.
BENNEL MACHINE CO ... 323
BOURNS LABORATORIES ... 334
Agency—The McCarty Co.
BRAND & CO., INC., WM ... 258
Agency—Cory Snow, Inc.
BREEZE CORPORATIONS, INC ... 159
Agency—Burke Dowling Adams, Inc.
BRISTOL COMPANY, THE ... 239
Agency—James Thomas Chirurg Co.
BRISTOL ENGINEERING CORP ... 307
Agency—J. D. Williams & Associates Inc.
BURNDY ENGINEERING CO ... 8
Agency—Ben Sackheim, Inc.
BURNS AERO SEAT CO., INC ... 152
Agency—The Buchanan Co. Inc.
CADILLAC GAGE ... 7
Agency—Wolfe, Jickling, Conley, Inc.
CAMLOC FASTENER CORP ... 96
Agency—Lewis Adv. Agency
CANNON ELECTRIC COMPANY ... 145
Agency—Willard C. Gregory & Co.
CARTER MOTOR COMPANY ... 331
Agency—Robert Peterson Adv. Agency
CENTURY CONTROLS ... 283, 329
Agency—Reiner Advertising
CEE-BEE CHEMICAL CO ... 84
Agency—The Esig Co.
CHAIN BELT CO., SHAFER BEARING DIV ... Insert 237
Agency—The Buchen Co.
CHANCE VOUGHT AIRCRAFT, INC ... Insert 44
Agency—Lennen & Newell, Inc.
CHANDLER EVANS DIV., NILES-BEMONT-POND CO. ... 252
Agency—Hugh H. Graham & Assoc., Inc.
CITIES SERVICE OIL CO ... 287
Agency—Ellington & Co., Inc.
CLIFFORD MFG. CO ... 314
Agency—James Thomas Chirurg Co.
CLIFTON PRECISION ... 119
Agency—Ivey Advertising Co.
CLEVELAND PNEUMATIC TOOL CO ... 74
Agency—Meldrum & Fewsmith, Inc.
COLLINS RADIO CO ... 22, 23
Agency—W. D. Lyon Co., Inc.
CONSOLIDATED DIESEL ELECTRIC CORP ... 179
CONSOLIDATED VULTEE AIRCRAFT CORP. ... Front Cover
Agency—Buchanan & Co., Inc.
CONTINENTAL MOTORS CORP ... 290, 291
Agency—Cummings & Hopkins Adv.
CONTROL PRODUCTS, INC ... 60
Agency—George Homer Martin Assoc.
COOK ELECTRIC CO ... 66
Agency—Glenn-Jordan-Stoeltzel Inc.
COOPER PRECISION PRODUCTS, INC. ... 109
Agency—Sindler Company
CORNELIUS CO. ... 129
Agency—Dwyer & Denot Adv.
CURTISS WRIGHT CORP ... 350
Agency—Burke Dowling Adams, Inc.
DAYSTROM INSTRUMENTS CO ... 81
Agency—Morse Advertisers
deHAVILLAND AIRCRAFT OF CANADA ... 339
Agency—Paul Taylor-Phelan, Ltd.
DELRON CO., INC. ... 272
Agency—Abbett Kimball Co. of Calif., Inc.
DESIGNERS FOR INDUSTRY ... 334
DOUGLAS AIRCRAFT CO ... 156, 157
Agency—J. Walter Thompson Co.
DOW CORNING CORP ... 293
Agency—Don Wagnitz Adv.
DUNBAR KAPPLE, INC ... 143
Agency—Ideas Unlimited
DYNAMIC AIR ENGINEERING INC. ... 234
Agency—The McCarty Co.
ECLIPSE-PIONEER DIV. BENDIX AVIATION CORP. ... 67, 77
Agency—MacManus, John & Adams, Inc.
EDISON, INC., THOMAS A ... 300
Agency—Gotham Adv. Co., Inc.
EDO CORPORATION ... 223
Agency—Mathews-Parsons Stromeier, Inc.
EKSTROM CARLSON ... 168
Agency—Cummings, Brand & McPherson
ELASTIC STOP NUT CORP ... 4th Cover
Agency—G. M. Basford Co.
ELECTROLIZING CORPORATION ... 197
Agency—Rutherland-Abbott
ELECTRO-SNAP SWITCH & MFG. CO ... 229
Agency—Glenn-Jordan-Stoeltzel, Inc.
ESSO EXPORT CORP ... 243
Agency—McCann Erickson, Inc.
FAIRCHILD ENGINE & AIRPLANE CORP ... 275
Agency—Gaynor & Co., Inc.
FEDERAL TELEPHONE & RADIO ... 17
Agency—J. M. Mathes, Inc.
FENWAL INC. ... 263
Agency—James Thomas Chirurg
FLETCHER AVIATION CORP ... 340
Agency—Hixson & Jorgensen, Inc. Adv.
FLEXONICS CORPORATION ... 6
Agency—Russell T. Gray, Inc.
FLIGHT REFUELING, INC ... 89
Agency—Davis-Parsons & Strohmeier, Inc.
FOOTE BROS. GEAR & MACHINE CORP ... 175
Agency—The Buchen Company
FORD INSTRUMENT CO ... 251
Agency—G. M. Basford Co.
GABRIEL ELEC. DIV. OF GABRIEL CO ... 104
Agency—Lareom Randall Advertising
GARRETT CORP., AIRESEARCH MFG. CO ... 238
Agency—J. Walter Thompson Co.
GENERAL ELECTRIC CO ... 224, 225, 308, 309
Agency—G. M. Basford
GENERAL SCIENTIFIC CORP ... 284
Agency—Byron H. Brown & Staff
GENISCO, INC. ... 232
Agency—Clyde D. Graham Adv.
GIANNINI & CO., INC., G. M ... 112
Agency—Mathes-Brady Agency, Inc.
GLADDEN PRODUCTS CORP ... 271
Agency—Walter C. Dayson Co.
GILFILLAN BROS., INC ... 269
Agency—Erwin, Wasey & Co.
GOODYEAR AIRCRAFT CORP ... 183
Agency—Kudner Agency, Inc.
GRAPHITE METALLIZING ... 151
Agency—The Kotula Co.
GREER HYDRAULICS, INC ... 231
Agency—Dunwoodie Adv. Service
HARPER CO., H. M ... 24
Agency—The Buchen Co.
HARTWELL AVIATION SUPPLY CO ... 86
Agency—The McCarty Company
HARTZELL PROPELLER CO ... 339
Agency—Kight Advertising, Inc.
HAYDON CO., A. W ... 88
Agency—Cory Snow, Inc.
HELI COIL CORP ... 113
Agency—O. S. Tyson & Co., Inc.
HELIPOT CORP. ... 284
Agency—Darwin H. Clark Co., Adv.
HETHERINGTON, INC. ... 235
Agency—The Harry P. Bridge Co.
HOLLY CARBURETOR CO ... 2nd Cover
Agency—Hidden Clifford Flint, Inc.
HONTI ENG. & MFG. CO ... 246
HOOVER ELECTRIC CO ... 301
Agency—Hixson & Jorgensen, Inc.
HUCK MFG. CO ... 188
Agency—The M. Gray & Assoc.
HOPKINS ENGINEERING CO ... 280
Agency—Walter Martin Advertising
HUFFORD MACHINE WORKS, INC ... 87
Agency—Clyde D. Graham Adv.
HYATT BEARINGS DIV., G.M.C. ... 83
Agency—The Buchen & Co.
HYDRO AIRE, INC. ... 245
Agency—Ben S. Investire Adv.
INDIANA GEAR WORKS ... 259
Agency—A. L. Perkins & Co.
INT. ELEC. RESEARCH CORP ... 140, 283
Agency—Jayegart Co.
INTERNATIONAL RESISTANCE CO ... 110
Agency—John Falkner Arndt & Co., Inc.
INTERNATIONAL STEEL CO ... 127
Agency—Keller Crescent Co.
ITE CIRCUIT BREAKER CO ... 128
Agency—Heiling & Co., Inc.
JACK & HEINTZ, INC. ... 182
Agency—Fuller & Smith & Ross, Inc.
JAMES-POND-CLARK ... 324
Agency—Western Ads Agency Inc.
JOHNS MANVILLE CORP ... 184
Agency—J. Walter Thompson Co.
KAWNEER CO., THE ... 333
Agency—Fuller, Smith & Ross, Inc.
KEARFOTT COMPANY, INC ... 92
Agency—M. Freystadt Associates
KETAY MFG. CORP ... Insert 97, 98, 99, 100
Agency—Hicks & Greist, Inc.
KIDDE & CO., INC., WALTER ... 3
Agency—Cunningham & Walsh, Inc.
KITTELL-LACY, INC. ... 265
Agency—Clyde D. Graham Adv.
KOHLER CO., THE ... 328
Agency—Roche, Williams & Cleary, Inc.
KOLLSMAN INSTRUMENT CORP ... 146
Agency—Schaefer & Faure Adv.
LAMSON & SESSIONS CO ... 14, 15
Agency—Belden & Hickox
LAND-AIR, INC. ... 244
Agency—Rhodes, MacKenzie & Co., Inc.
LAPOINTE MACHINE TOOL CO., THE ... 164
Agency—Wells Advertising Agency
LAVELLE AIRCRAFT CORP ... 248
Agency—Grace Marston, Inc.
LEACH RELAY CO ... 178
Agency—The McCarty Co.
LEAR, INC. ... 209
Agency—Buchanan & Co., Inc.
LEWIS ENGINEERING CO ... 189
LIBRASCOPE, INCORPORATED ... 303
Agency—The McCarty Co.
LINK AVIATION, INC. ... 190
Agency—Gaynor & Co., Inc.
LIQUIDOMETER CORP. ... 9
LOCKHEED AIRCRAFT CORP ... 218, 219
Agency—Foote, Cone & Belding, Adv.
LOCKHEED AIRCRAFT CORP ... 330, 331
Agency—Hal Stebbins Adv.
LORD MFG. CO ... 139
Agency—Davies & McKinnes Adv.
LUNDY MFG. CO ... 84
Agency—Mitchell Advertising Agency
LYCOMING DIVISIONS—AVCO MANUFACTURING CORP. ... 326
Agency—Benton & Bowles, Inc.
MANNING, MAXWELL & MOORE, INC ... 28
Agency—Fuller & Smith & Ross, Adv. Inc.
MARMAN PRODUCTS CO ... 105
Agency—West Marquis, Inc.
MARQUARDT AIRCRAFT CO ... 260
Agency—Beaumont, Heller & Sperling, Inc.
MARTIN CO., THE GLENN L ... 325
Agency—Vansant, Dugdale & Co., Inc.
McCULLOCH MOTORS CORP ... 221
Agency—West-Marquis, Inc.
MECHANEERS, INC. ... 274
MECHANICAL SUSPENSION MOUNT CO ... 256
MELETRON CORPORATION ... 132
Agency—Welsh Hollander Adv.
MILLER DIAL & NAME PLATE CO ... 280
Agency—Welsh Hollander Adv.
MINNEAPOLIS HONEYWELL REGULATOR CO. ... 176, 177
Agency—Foote, Cone & Belding
MINNESOTA MINING & MFG. CO ... 21
Agency—Batten, Barton, Durstine & Osborn, Inc.
MONADNOCK MILLS, UNITED CARR FASTENER CORP. ... 29
Agency—H. B. Humphres, Alley & Richards, Inc.
MONOGRAM MFG. CO ... 69
Agency—Taggart & Young Adv.
MONSANTO CHEMICAL CO ... 124
Agency—Gardner Advertising Co.
MYCALEX CORP. OF AMERICA ... 165
Agency—George Homer Martin Assoc.
NATIONAL TUBE FORMING CO ... 276
NEW HAMPSHIRE BALL BEARINGS INC ... 280
Agency—Elsworth W. Bunce & Associates
NEW YORK AIR BRAKE CO., THE ... 13
Agency—Humbert & Jones Adv.
NOPCO CHEMICAL COMPANY ... 282
Agency—Lewin, Williams & Saylor, Inc.
NORTHROP AIRCRAFT, INC ... 151
Agency—West-Marquis, Inc.
NUTT SHEL COMPANY ... 337
Agency—Welsh-Hollander Adv.
OHIO SEAMLESS TUBE CO ... 257
Agency—Howard Swink Adv. Agency
ONSRUD CUTTER MFG. CO ... 276
Agency—Robert Peterson Adv. Agency
PACIFIC AIRMOTIVE CORP ... 27
Agency—Buchanan & Co., Inc.
PAN ELECTRONICS CORP. ... 274
Agency—Bruce Mercer & Co.
PARKER AIRCRAFT CO ... 72, 73
Agency—Fuller & Smith & Ross, Inc.
PASTUSHIN AVIATION CORP ... Insert 64
Agency—Lynn Western, Inc.
PHILLIPS PETROLEUM CO ... 5
Agency—Lambert & Feasley, Inc.
PHOENIX ELECTRIC MFG. CO ... 152
Agency—Armstrong Advertising
PIERCE GOVERNOR & CO ... 240
Agency—LaGrange & Garrison Inc.
PIONEER PARACHUTE CO ... 348
Agency—Julian Gross Advertising Agency
PITTSBURGH PLATE GLASS CO. (SAFETY GLASS) ... 193
Agency—Batten, Barton, Durstine & Osborn, Inc.
POTTER & BRUMFIELD ... 148
Agency—LaGrange & Garrison, Inc.
PUROLATOR PRODUCTS, INC. ... 103
Agency—Walter Thompson Co.
RADIO CORP. OF AMERICA ... 267
Agency—J. Walter Thompson Co.
READING BATTERIES INC ... 286
Agency—The William B. Kamp, Co.
RED BANK DIV., BENDIX AVIATION CORP ... 185
Agency—MacManus, John & Adams, Inc.
REID ENTERPRISES ... 276
Agency—Dick Donald Advertising

REMINGTON RAND, INC. 123
Agency—Leeford Adv. Agency, Inc.
RESIN INDUSTRIES INC. 108
Agency—Taggart & Young Adv.
REVERE CORP. OF AMERICA 186
Agency—Triland, Inc.
RHEEM MFG .CO ..... Insert 157
Agency—Campbell-Ewald Co.
RIVERSIDE METAL CO 85
Agency—Robert S. Kaufmann, Jr.
ROBERTSHAW-FULTON CONTROLS CO 174
Agency—The Griswold-Eshleman Co.
ROBINSON CO., RALPH C. 334
Agency—Chapin-Damm Advertising
ROHM & HAAS CO. 25
Agency—John Falkner Arndt & Co., Inc.
ROHR AIRCRAFT CORP. 267
Agency—Barnes Chase Co.
ROLAND TEINER CO. 192
Agency—Gordon Speedie Ads.
ROSEN, RAYMOND, ENGINEERING PROD. 140
Agency—Al Paul Lefton Co., Inc.
ROYAL JET, INC. 285
Agency—Bayliard O'Connor Ads.
RYAN AERONAUTICAL CORP. 277
Agency—Batten, Barton, Durstine & Osborn, Inc.
SAGINAW STEERING GEAR DIV., G.M.C. 219
Agency—Price, Hedrick & Tanner, Inc.
SAWYER & SON, H. M. 147
Agency—McMillan & Marsden, Inc.
SCHULZ TOOL & MFG. CO. 198
SCINTILLA MAGNETO DIV., BENDIX AVIATION CORP. 241
Agency—MacManus, John & Adams, Inc.
SEARCHLIGHT SECTION ..... 340 to 347
SERVOMECHANISMS, INC. 115
Agency—Sanger-Funnell, Inc.
SHELL OIL CO. 149
Agency—J. Walter Thompson Co.
SHERIDAN CO., T. W. & C. B. 295
Agency—Stieler, Millar & Lester, Inc.
SIMMONDS AEROCESSORIES, INC. 281
Agency—Burke Dowling Adams, Inc.
SINCLAIR REFINING CO. 10, 11
Agency—Morey, Humm & Johnstone, Inc.
SMITH MORRIS CORP. 278, 279
SOCONY VACUUM OIL CO. 16
Agency—Compton Advertising, Inc.
SOUTHWEST PRODUCTS CO. 311
Agency—O. K. Faxan Adv. Agency
SPECIAL MACHINE TOOL ENGINEERING WORKS 217
Agency—Fred Wittner Advertising
SPENCER THERMOSTAT DIV., METALS & CONTROLS CORP. 141
Agency—Sutherland-Abbott Ads.
SPERRY GYROSCOPE CO. ..... 116, 117, 3rd Cover
Agency—Beach, Yates & Mattoon Adv.
STANDARD PRESSED STEEL CO. 215
Agency—Gray & Rogers Adv.
STANDARD THOMSON CORP. 228
Agency—Caldwell, Larkin & Co., Inc.
STANPAT CO. 186
STAR STAINLESS SCREW CO. 340
Agency—Harold Marshall Ads. Co.
STEEL PRODUCTS ENGINEERING CO. 306
Agency—Geyer Advertising, Inc.
STEWART WARNER CORP. 134
Agency—MacFarland, Aveyard & Co.
STRATOFLEX 190
Agency—Glenn Adv. Inc.
STROKOFF AIRCRAFT CORP. 269
SUMMERS GYROSCOPE CO. 12
Agency—Byron H. Brown & Staff
SURFACE COMBUSTION CORP. 71
Agency—Osborne Industrial Adv.
THERMO ELECTRIC CO. 153
Agency—Fred Lange Assoc., Inc.
THOMPSON AIRCRAFT TIRE CORP. 155
Agency—Norton M. Jacobs, Adv. Agency
THOMPSON FIBER GLASS CO., H. I. 298
Agency—Abbott-Kimball Co. of Calif.
TITEFLEX, INC. 321
Agency—John Falkner Arndt & Co.
TOPPS INDUSTRIES 315
Agency—Willard G. Gregory & Co.
TORRINGTON CO., THE 318
Agency—Hazard Advertising Co.
TOWNSEND COMPANY 288, 289
Agency—Bond & Starr, Inc.
TRANSPORT EQUIPMENT CO. 114
Agency—Jayeratt Co.
TRANS WORLD AIRLINES, INC. 273
Agency—Batten, Barton, Durstine & Osborn, Inc.
TUBE METHODS, INC. 75
Agency—John Miller Adv. Agency
TUBING SEAL CAP, INC. 200
Agency—E. J. C. Spinatice Adv.
TWIGG INDUSTRIES, INC. 302
Agency—La Grange & Garrison, Inc.
TWIN COACH CO. 297
Agency—Palm & Patterson, Inc.
U. S. BOBBIN & SHUTTLE CO., HY-DU-LIGNUM DIV. 335
Agency—Wells Advertising Agency
UNIVERSAL METAL PRODUCTS 292
Agency—Byron H. Brown & Staff
UTICA DROP FORGE & TOOL CORP. 317
Agency—Wilson, Haight & Welch, Inc.
VAPOR BLAST MFG. CO. 322
Agency—Morrison-Greene-Seymour, Inc.
VARD, INC. 170
Agency—The McCarty Co.
VERSON ALLSTEEL PRESS CO. 329
Agency—Russell T. Gray
VICKERS, INC. 194
Agency—Witte & Burden Adv.
VOI-SHAN MFG. CO., INC. ..... Insert 133
Agency—Anderson-McConnell Adv. Agency
VULCAN RUBBER PROD. INC., A SUBSIDIARY OF REEVES BROS. INC. 130
Agency—Gould & Tierney, Inc.
WARNER DIV., DETROIT HARVESTER CO. 236
Agency—Clark & Bobertz, Inc.
WATERTOWN DIVISION, THE NEW YORK AIR-BRAKE CO. 13
Agency—Humbert & Jones Adv.
WEBER AIRCRAFT CORP. 20
Agency—Buthrauff & Ryan, Inc.
WELCRAFT PRODS. CO. 338
Agency—Lincoln J. Carter Adv. Agency
WESTERN GEAR WORKS 199
Agency—Buthrauff & Ryan, Inc.
WESTINGHOUSE ELECTRIC CORP. ..... Insert 201, 202, 203, 204
Agency—Fuller & Smith & Ross, Inc.
WHITTAKER CO., LTD., WM. R. 242
Agency—Mogge-Privett, Inc.
WICKES ENGINEERING & CONSTRUCTION CO. 261
WIGGINS OIL TOOL CO., E. B. 191
Agency—Anderson-McConnell Adv. Agency
WILCOX ELECTRIC CO. 213
Agency—Carter Adv. Agency, Inc.
WILDING PICTURE PRODUCTIONS 304
WINCHESTER ELECTRONICS, INC. 233
Agency—The Kotula Co.
WYANDOTTE CHEMICALS CORP. 162
Agency—Brooke, Smith, French & Dorrance, Inc.
WYMAN GORDON CO. 26
Agency—John W. Odlin Co., Inc.
ZEP AERO & BREATHING EQUIPMENT CO. 126
Agency—The Shaw Company

SEARCHLIGHT SECTION
(Classified Advertising)
H. E. Hilty, Mgr.

EMPLOYMENT
Positions Vacant 341-344
Selling Opportunities Offered 344
Positions Wanted 344

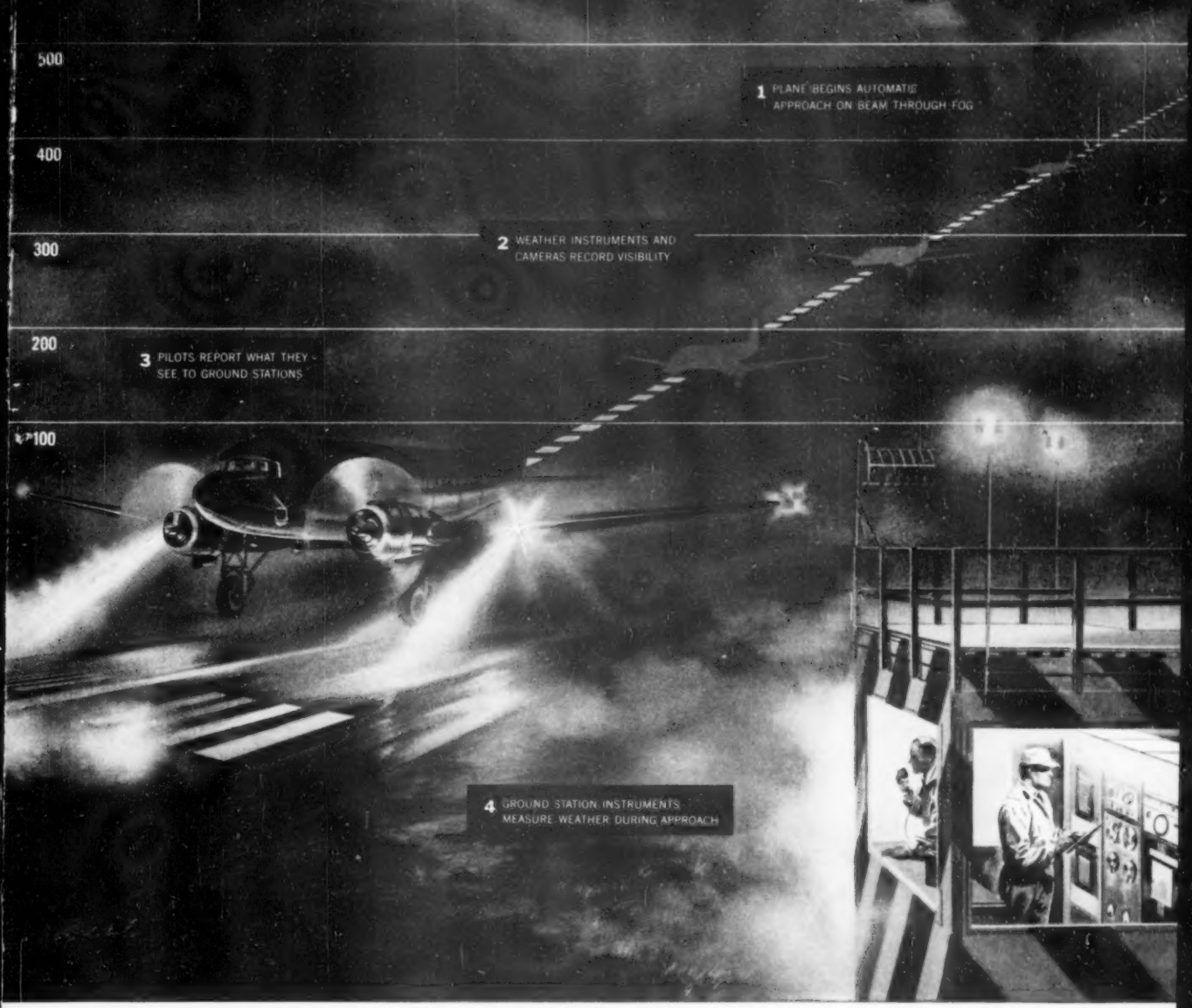
SPECIAL SERVICES
Contract Work Wanted 340

NOTICES
Proposal 344

PLANES—EQUIPMENT
(Used or Surplus New)
For Sale 340, 345-347

24 LEADING WORLD AIRLINES HAVE SELECTED TURBO COMPOUNDS
NATIONAL AIRLINES
selects TURBO COMPOUNDS
to shorten New York – Miami time with
DOUGLAS DC-7's.
CURTISS-WRIGHT
CORPORATION • WOOD-RIDGE, N. J.
World's Finest Aircraft Engines

AIR FRANCE • AIR-INDIA INTERNATIONAL • AMERICAN AIRLINES • AVIANCA • CUBANA • DELTA-C & S AIRLINES NORTHWEST AIRLINES • EASTERN AIRLINES • THAI AIRWAYS COMPANY LIMITED • IBERIA-LINEAS ESPANOLAS • PAN AMERICAN GRACE AIRWAYS • KLM ROYAL DUTCH AIRLINES • LINEA AEROPOSTAL VENEZOLANA • WEST GERMAN AIR LINES • NATIONAL AIRLINES • PAK AIR LIMITED • QANTAS EMPIRE AIRWAYS, LTD. • SEABOARD & WESTERN AIRLINES • TRANS-CANADA AIR LINES • TRANS WORLD AIRLINES • UNITED AIR LINES • "VARIG" BRAZILIAN AIRLINES • PAN AMERICAN WORLD AIRWAYS


500
400
300
200
100
1 PLANE BEGINS AUTOMATIC APPROACH ON BEAM THROUGH FOG
2 WEATHER INSTRUMENTS AND CAMERAS RECORD VISIBILITY
3 PILOTS REPORT WHAT THEY SEE TO GROUND STATIONS
4 GROUND STATION INSTRUMENTS MEASURE WEATHER DURING APPROACH

Flying Lab makes 500 Landing Approaches in "Pea Soup"

THE STORY BEHIND THE STORY:

■ IF YOU'VE BEEN a passenger in a plane "stacked" above a fogged-in airport—or if you've been the pilot at the controls—you were certainly interested in headlines like the above appearing in newspapers a few months ago.

■ Behind those headlines is the dramatic story of men flying when "even the birds are walking," making landing approaches over and over again, to make your future landings safer in bad weather.

■ Working with the Air Navigation Development Board and the U. S. Weather Bureau, Sperry flight research personnel have completed 500 bad weather landing approaches in a flying laboratory equipped with specialized instruments. In flight, both manual and automatic recordings are made of conditions encountered during the final 500 feet of descent.

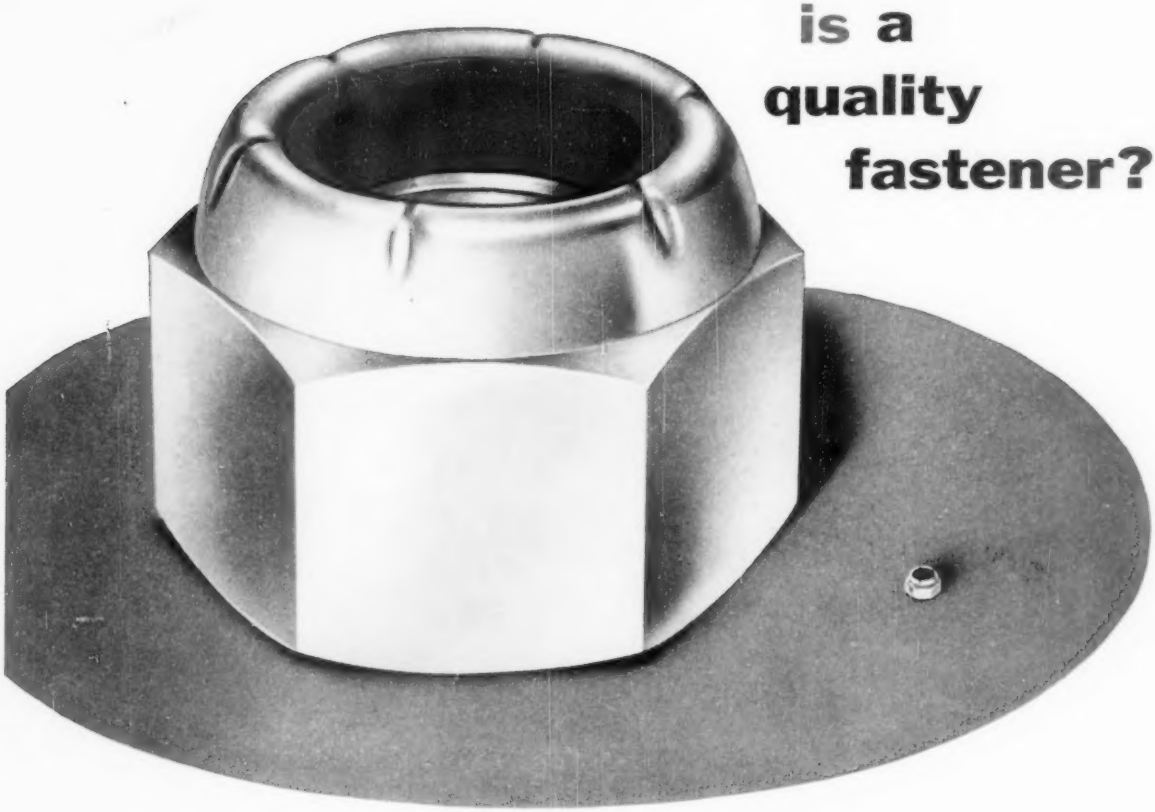
■ On the ground, trained observers report what they see, and monitor automatic instruments which measure ceiling and visibility conditions existing in the runway approach zone. Synchronized and analyzed, these records reveal the accuracy of the instruments and establish a wealth of information so pilots will know what weather to expect along the line of descent.

■ Because of its many years of experience in low ceiling approaches, Sperry was selected by the government to make the weather measurement study. This project is typical of the exacting flight research which is continuous at Sperry—flight research not only to perfect Sperry instruments and controls, but to advance the operational efficiency of both commercial and military aircraft.

SPERRY GYROSCOPE COMPANY

DIVISION OF THE SPERRY CORPORATION ● GREAT NECK, N.Y.

What size is a quality fastener?



Here are two ELASTIC STOP® nuts.
Each has the familiar red locking collar. Each is self-locking, vibration-proof and can be reused many times. Each is a fast, readily assembled one-piece unit . . . will maintain accurate adjustment anywhere on a bolt. Each will afford positive protection against thread corrosion . . . prevent liquid seepage along bolts. Each is manufactured in quantity. Each is exactly controlled as to quality of raw material, finished dimensions, class of thread fit, seat squareness and finish. Each has a record for precision and uniformly high performance that is unmatched.

But . . . one measures 1 10 inch across the flats; the other, 4 inches. Between these two, there are more than 530 different hex nuts in the ESNA line. They are the result of variations in height, material, finish and size.

Look to ESNA for the top quality self-locking fastener that fits your need best.

ELASTIC STOP NUT CORPORATION OF AMERICA

ESNA® TRADE MARK

ROLLPIN TRADEMARK

Elastic Stop Nut Corporation of America
Dept. N58-325, 2330 Vauxhall Road, Union, N. J.
Please send the following free fastening information:

☐ ELASTIC STOP nut bulletin

☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name _____ Title _____

Firm _____

Street _____

City _____ Zone _____ State _____